Bull Trout
Species Account

Prepared for

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Montana DNRC Forested Trust Land HCP Species Account

The enclosed "species account" was prepared to provide background information used for the development of the Montana DNRC Forested Trust Lands HCP. Species accounts identify the best available science for each species. Species accounts were reviewed by DNRC and USFWS when negotiating the HCP conservation strategies to ensure that these strategies would be biologically and technically sound and that the strategies would be advantageous to species conservation. The species accounts will also used to prepare chapter sections of the HCP and EIS. Use of species account information for the HCP was particularly important when (1) selecting where the HCP conservation strategies would be of maximum benefit for the HCP species on DNRC lands [i.e, project area], (2) selecting computer models in predicting how the existing DNRC management actions and the proposed alternatives affect each HCP species, (3) determining how existing DNRC monitoring and adaptive manage programs can be used to support the HCP, and (4) developing rationale for species conservation strategies. Species account information will be used in the EIS for preparing the affected environment section for each HCP species and for describing how existing DNRC harvest practices and associated road construction affect HCP species.

Species account information was acquired by reviewing recent relevant publications and contacting key experts in Montana and the intermountain states that were knowledgeable about recent unpublished research for each species. Species agency listing status and species distribution in Montana were also reviewed. Maps are included that provide approximate known distribution for each species.

The species account descriptions also provide information about the existing protective measures that are required by federal and state laws and regulations or were agreed to by DNRC through conservation or related agreements. Other information contained in the species accounts includes additional conservation measures developed by other agencies or HCP applicants and existing DNRC monitoring and research programs. Finally, references are provided for the background information acquired for each species.

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ACRONYMS

ARM	Administrative Rules of Montana
BMP	Best management practices
C	Celsius
CMZ	channel migrations zones
dbh	diameter-at-breast-height
DNRC	Department of Natural Resources and Conservation
DPS	distinct population segment
EA	Environmental assessment
EDT	Ecosystem Diagnosis and Treatment
ft.	feet
FR	Federal Register
GMRD	geometric mean road density
HCP	habitat conservation plan
INFISH	Inland Native Fish Strategy
LWD	large woody debris
MBTRT	Montana Bull Trout Restoration Team
MBTSG	Montana Bull Trout Scientific Group
MCA	Montana Code Annotated
MFWP	Montana Fish, Wildlife, and Parks
MNHP	Montana Natural Heritage Program
NEPA	National Environmental Policy Act
OHWM	ordinary high water mark
QHA	Qualitative Habitat Assessment
RCAs	restoration/conservation areas
RHCA	Riparian Habitat Conservation Area
RMO	Riparian Management Objective
RMZ	riparian management zone
SFLMP	State Forest Land Management Plan
SMZ	Streamside Management Zone
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
WMZ	wetland management zone

1. CURRENT LEGAL AND AGENCY STATUS

Information on the legal and agency status of bull trout (*Salvelinus confluentus*) was obtained from *Montana Animal Species of Concern* (Carlson 2003) published jointly by Montana Fish, Wildlife and Parks (MFWP) and the Montana Natural Heritage Program (MNHP). This includes information from the federal and state agencies listed below, except for the Montana Department of Natural Resources and Conservation (DNRC), and except where a reference indicates otherwise. The DNRC information was provided in an email from Gary Frank (2003a, personal communication).

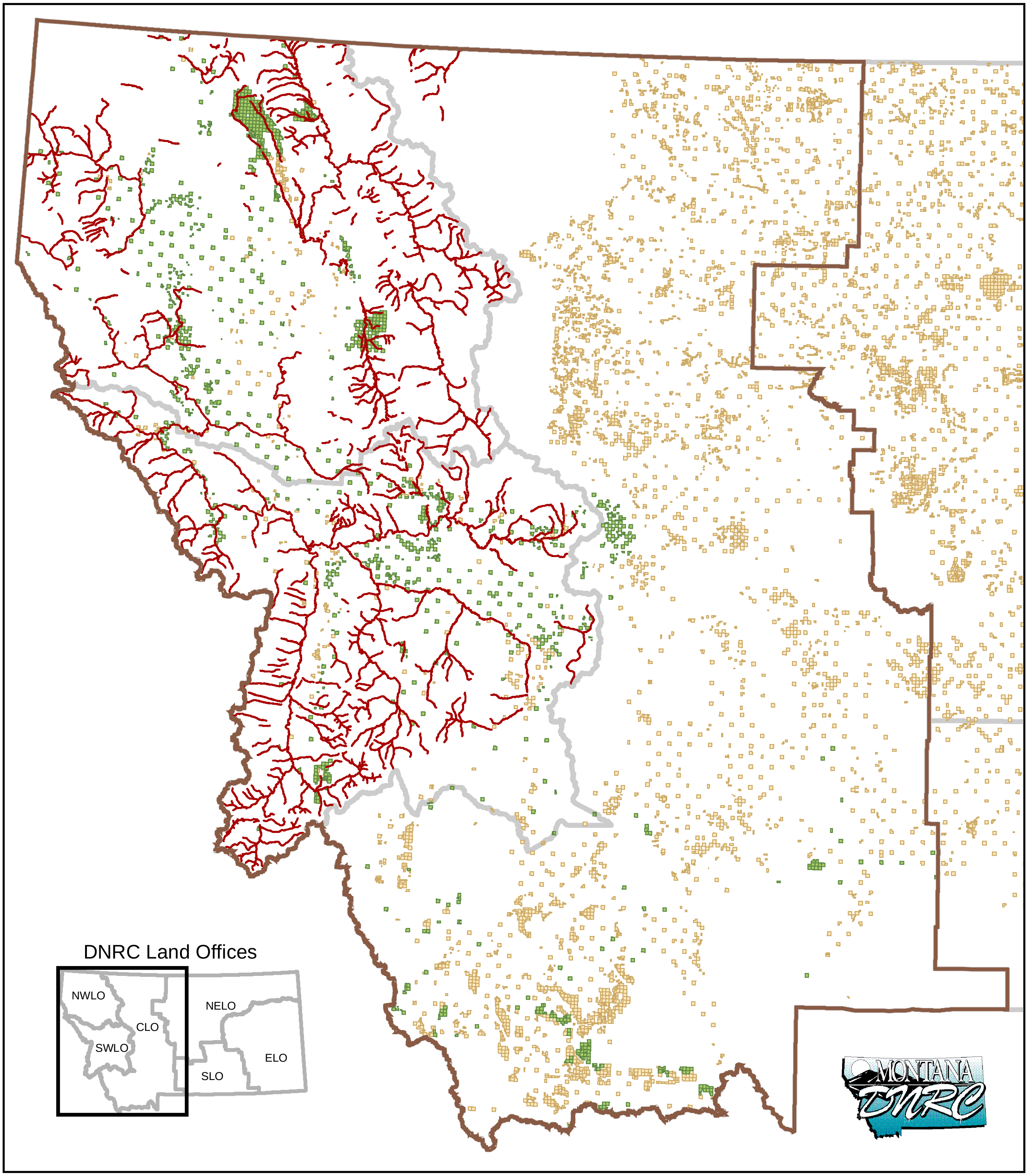
- U.S. Fish and Wildlife Service (USFWS)—federally threatened (USFWS 1998a, 1999).
- MFWP/MNHP—Species of concern. State ranking of S2 (imperiled because of rarity or other factor(s), making it very vulnerable to extinction throughout its range).
- DNRC Forest Management Bureau—follows USFWS listing.
- U.S. Forest Service (USFS), Montana—sensitive.
- U.S. Bureau of Land Management—no special status.

2. POPULATION STATUS, DISTRIBUTION, AND SEASONAL PRESENCE

On June 10, 1998, USFWS published a final rule in the Federal Register (63 FR 31647) determining the Klamath River and Columbia River population segments of bull trout to have threatened status under the Endangered Species Act of 1973. At the time of listing, the finding was made that critical habitat was not determinable for these populations because their habitat needs were not sufficiently well known. On November 12, 2002, USFWS proposed designation of critical habitat for the Klamath River and Columbia River distinct population segments of bull trout. For the Columbia River distinct population segment (DPS), the proposed critical habitat designation totals approximately 18,175 miles of streams and 498,782 acres of lakes and reservoirs, which includes approximately 3,319 miles of streams and 217,577 acres of lakes and reservoirs in the State of Montana.

The current MNHP data for bull trout distribution in Montana (Figure 1) are dated January 2001. Riggers (personal communication) stated that the existing bull trout distribution maps are generally accurate, particularly for the larger, known populations of bull trout. Due to sampling limitations and the low densities of smaller, isolated populations, the mapping accuracy of this latter group may, however, underrepresent the true statewide distribution of bull trout in headwaters or isolated drainages. In addition, he stated that these small, isolated populations are in such small numbers that they are not viable and, therefore, do not represent a major issue for the management or recovery of bull trout. Weaver (2003, personal communication) indicated that the existing bull trout distribution maps for Montana are quite accurate and that small numbers of bull trout in headwaters or low-order streams likely may not represent a true population, but isolated sub-adults from downstream ascending to upstream habitat. He indicated that there has been a large amount of recent discussion as to what constitutes a "bull trout stream." McDonald and Shepard (personal communications) also concurred that the current bull trout distribution maps are accurate.

Bull trout historically occurred in major river drainages in the Pacific Northwest from northern California and Nevada to the headwaters of the Yukon River, Canada, throughout the headwaters of the Columbia River drainage, and eastward into the Saskatchewan River in Canada (Cavender 1978). They are widely distributed across their range but their distribution tends to be patchy, even in pristine environments (Rieman and McIntyre 1993). Bull trout have been extirpated from many of the large rivers within their historic range and in many watersheds, remaining bull trout are small, resident fish isolated in headwater (2nd to 3rd order) streams.



Bull Trout Distribution

Project Area

Other Trust Land

Planning Area Boundary

Land Office Boundary

Data Source: Montana Department of Fish, Wildlife & Parks MFISH Database (downloaded September 2, 2003).

Parametrix

Map prepared by Parametrix, Inc., September 29, 2005.
bull_trout_sa-20050929.mxd

Figure 1
Bull Trout Distribution in Western Montana

The USFWS (1998a) recently completed a determination of the status of bull trout, identifying five DPSs in the continental United States (US): the Columbia River, Klamath River, Jarbidge River, St. Mary-Belly River, and Coastal-Puget Sound bull trout DPSs. In the Columbia River, genetic investigations have further identified two separate evolutionary groups of bull trout, a lower and an upper Columbia River group (Williams et al. 1997). Bull trout in Montana lie within the upper Columbia River, where a high level of genetic diversity has been observed between bull trout populations in different drainages, but where little genetic variation exists within the individual drainages (Williams et al. 1997). These facts indicate that each major river drainage in the upper Columbia River region harbors its own unique strain of bull trout, whose continued existence is important to the species as a whole (Kanda et al. 1997).

Bull trout distribution, abundance, and habitat quality have declined rangewide (Thomas 1992; Rieman and McIntyre 1993; McPhail and Baxter 1996). USFWS (2002) have identified the main threats to bull trout persistence as habitat fragmentation and degradation, passage barriers that isolate populations, competition and predation from nonnative fishes, angling mortality, and effects resulting from isolation and small population sizes. Specific land and water management activities that depress bull trout populations and degrade habitat (as summarized in USFWS [2002]) include dams and other diversion structures, forest management practices, livestock grazing, agriculture, agricultural diversions, road construction and maintenance, mining, and urban and rural development.

Of the four life history forms generally recognized for bull trout—resident (non-migratory), adfluvial (lake dwelling), fluvial (migratory stream and river dwelling), and anadromous (saltwater migratory) fish—all but the anadromous form exist in Montana. Within the state, bull trout remain widely distributed throughout their historic range, although numbers and distribution have declined during the past century (Montana Bull Trout Scientific Group [MBTSG 1995a-e; MBTSG 1996a-f]). Bull trout are native to the streams and rivers within the Columbia River Basin in Montana where they occupy two major subbasins, the Kootenai and Clark Fork drainages west of the Continental Divide. In addition, they occupy the Saskatchewan River Drainage east of the Continental Divide. Within these subbasins, bull trout are found in several major river drainages, including the Blackfoot, Clark Fork, Swan, Flathead, and Kootenai rivers (Figure A-1). The Clark Fork River population has been isolated from the rest of the Columbia River populations for at least 10,000 years by Albeni Falls, and the Kootenai River population has been separated by Bonnington Falls, downstream of Kootenay Lake in British Columbia. The Swan River, South Fork Flathead, and upper Kootenai River populations appear to be increasing. Migratory bull trout populations in the Clark Fork, Blackfoot, Flathead (excluding the South Fork Flathead River), and Bitterroot rivers have suffered large declines in abundance and distribution since European settlement (MBTSG 1995a-e; MBTSG 1996a-f). In Montana, some resident headwater populations have become isolated or extirpated due to fish passage barriers and migratory forms of bull trout have lost access to large portions of habitat due to the construction of structures that are major passage barriers (e.g. Libby Dam).

Maintenance of migratory corridors for bull trout is essential to provide connectivity among local populations, and enables the reestablishment of extinct resident populations. If resident bull trout are extirpated or impacted by a disturbance to local populations or habitats, these populations cannot be replenished or the local habitat recolonized if limits to connectivity preclude migratory bull trout from entering the disturbed area (Rieman and McIntyre 1993).

3. KEY LIFE REQUISITES

Resident fish usually spend their entire lives in smaller tributaries and headwater streams, while sub-adult and adult migratory forms live in tributary streams for several years before migrating to larger rivers (fluvial form) or lakes (adfluvial form). Both of these forms spawn only in smaller tributary streams. In Montana, spawning has been documented in second- through fifth-order streams (Shepard et al. 1984).

Bull trout have multiple life history strategies, including migratory forms, throughout their range (Rieman and McIntyre 1993). Resident and migratory form may be found together, and either form may give rise to offspring exhibiting either resident or migratory behavior (Rieman and McIntyre 1993). Migratory forms appear to develop when habitat conditions allow movement between spawning and rearing streams and larger rivers or lakes where foraging opportunities may be enhanced (Frissell 1993).

Bull trout have more specific habitat requirements than most other salmonids (Rieman and McIntyre 1993). Habitat components that influence bull trout distribution and abundance, in approximate order of importance, include:

- cold water temperatures,
- suitable substrate and lack of sediment,
- habitat complexity, and
- habitat connectivity.

Habitat features that directly contribute to these components include high levels of shade, undercut banks, and woody debris in streams; high levels of gravel in riffles and low levels of fine sediments; stable, complex stream channels; and connectivity among and between drainages. Other important general habitat factors that may have a large influence on bull trout distribution in Montana (Weaver, personal communication) are:

- stream flow – particularly late summer low flows that coincide with bull trout spawn timing, and
- stream gradient –3 to 5 percent gradient is the maximum for bull trout spawning, with less than 2 percent preferable.

Bull trout are likely to occur in colder, higher elevation, low- to mid-order watersheds having a lower road density (Rieman et al. 1997). Bull trout are less likely to use streams for spawning and rearing in high road density areas. Rieman and McIntyre (1995) considered road networks in their observations of bull trout habitat preferences, finding a direct correlation with low road density blocks of 12,355 acres (5,000 hectares) or more. In the Swan Basin, Frissell et al. (1995) found a significant correlation between high ratings of aquatic biodiversity elements (including bull trout presence) and low road densities. Quigley and Arbelbide (1997), in a study that covered the entire Columbia River Basin and portions of the Klamath and Great Basins, found that bull trout were depressed when the geometric mean road density (GMRD) was at 0.67 miles of road per square mile of area and were absent when GMRD the was 1.13 miles of road per square mile of area.

Roads contribute to stream sedimentation, and roads adjacent to streams can reduce the amount of riparian vegetation, which may result in increased stream temperatures. Water temperatures above 15 degrees Celsius (°C) are believed to limit bull trout distribution (Fraley and Shepard 1989; Rieman and McIntyre 1993), and this may partially explain why bull trout have a generally patchy distribution within a given watershed. Small changes in temperature (1 or 2 °C) can have potential negative affects on native fish, including bull trout, by altering habitat conditions so they favor displacement or invasion from a nonnative species (Shepard, personal communication). Spawning of bull trout appears to be triggered when water temperatures drop below 10°C (Bjornn 1991) (Table 1). Spawning habitat almost invariably consists of very clean gravel, often in areas of groundwater upwelling or cold spring inflow (Rieman and McIntyre 1993).

Table 1. Quantifiable Ecosystem Attributes for Bull Trout

Life Stage/Attribute	Need	Preference
Spawning		
Spawning Water Depth	0.3 to 2.0 ft.[a]	1.0 ft.[a].; 2.0 ft.[b]
Spawning Water Velocity	0.3 to 2.0 ft./sec[a]	1.0 ft./sec[a]; 1.1 ft./sec[b]
Spawning Substrate	Gravel/small cobble[c]	Varies with spawner size usually small or large gravels[c]; <12percent fines[u]
Spawning Temperature	Daily max water temperature below 10 to 11°C[d]	Areas influenced by groundwater[e,f]; 4-9°C[u]
Incubation		
Fine (<6.35mm) Sediment Particles Present in Substrate	<30 percent[g]	<10 percent[h]
Incubation Temperature	Below 8°C[d]	2 to 4°C with groundwater influence[d, i]; 2 to 5 °C[u]
Rearing		
Juvenile Rearing Temperature	Below 15°C[c]	7 to 8°C with groundwater influence[l]; 4 to 10°C[j]; 4-12°C[u]
Cover		Complex and overhead cover[b, c]
Pools		Large pools >1.6 ft. in depth[k]
Substrate		Cobbles and boulders[b, c]; embeddedness <20 percent
Adult/Migratory		
Migratory Corridor Temperature	Water does not exceed 15°C for extended periods[c, l, m, n]	Thermal refugia in form of deep pools, lakes, groundwater influence, or cold tributary plumes[e, i, o, p]
Fish Access /Connectivity		No manmade fish passage barriers to limit connectivity of bull trout habitats[q, r,u]
Feeding and Growth		Variety of native fish prey and aquatic insects. Absence of introduced competitors (i.e., lake trout)[s, t]

Sources:

[a] Shepard et al. (1982)
[b] Baxter (1995)
[c] Fraley and Shepard (1989)
[d] McPhail and Murray (1979)
[e] Shepard et al. (1984)
[f] Brown (1992)
[g] Weaver and Fraley (1981)
[h] James and Sexhauer (1997)
[i] Goetz (1989)
[j] Buchanan and Gregory (1997)
[k] Jakober (1995)
[m] Brown (1992)
[n] Donald and Alger (1993)
[o] Swanberg (1997)
[p] Frissell and Cavallo In MBTSC (1998)
[q] Reiman and McIntyre (1993)
[r] Thomas (1992)
[s] McPhail and Baxter (1996)
[t] USFWS (2002)
[u] USFWS (1998c)

Bull trout typically spawn in areas affected by groundwater (Shepard et al. 1984; Fraley and Shepard 1989). These areas (such as the Flathead drainage) tend to remain as open water through the winter, thereby reducing the risk of redd dewatering or freezing during harsh winter conditions. Groundwater-affected areas also allow bull trout embryos to develop and emerge faster than they would in drainages with colder winter water temperatures (Weaver and Fraley 1991).

In general, available information indicates that bull trout typically spawn in colder, higher elevation, and low- to mid-order watersheds with lower road density because these areas contain habitat that meets their spawning requirements for temperature and substrate (Rieman et al. 1997). Bull trout spawn from late August to early November, and their eggs remain up to 10 inches deep in spawning gravel.

Egg incubation temperatures can range up to 8 ºC, although optimal temperatures for survival are in the range from 2 to 4 ºC (McPhail and Murray 1979; Goetz 1989). Bull trout eggs require approximately 100 to 145 days to hatch, followed by an additional 65 to 90 days of yolk-sac absorption during alevin incubation. Thus, in-gravel incubation spans from 6 to 8 months, depending on water temperature. Hatching occurs in winter or late spring and fry emergence occurs from early April through May (Rieman and McIntyre 1993).

Excessive sedimentation or substrate movement reduces bull trout production by increasing egg and juvenile mortality and reducing or eliminating habitat important to later life history stages (Fraley and Shepard 1989; Brown 1992). Prime sources of egg and fry mortality include scouring of redds due to high flows, freezing during low flows, superimposition of redds (overlapping nests in areas of limited spawning habitat availability), or deposition of fine sediment or organic materials that smother eggs or fry (MBTSG 1998).

Generally, for their first 1 to 2 years, fluvial bull trout juveniles rear near their natal tributary and exhibit a preference for cool water temperatures, although they appear less restricted by temperature than do spawning bull trout (Bjornn 1991). Newly emerged bull trout fry are often found in shallow, backwater areas of streams that contain woody debris or other forms of complex overhead cover, including boulders or undercut banks (Baxter 1995). Later, or in other habitats lacking woody debris for refugia, fry are bottom dwellers and may occupy interstitial spaces in the streambed (Brown 1992). In the Flathead River tributaries, older juveniles were found to be more abundant in pools than in riffles (McPhail and Baxter 1996).

Two of the life history forms of bull trout in the upper Columbia River (fluvial and adfluvial) migrate as a normal part of their life cycle. Downstream migration affords access to denser forage, better protection from avian and terrestrial predators, and alleviates potential intraspecific competition or cannibalism in rearing areas (Schlosser 1991). However, migratory juvenile bull trout face a variety of natural and human-caused threats to their survival after they leave their natal tributaries.

Migratory native bull trout typically remain in tributary streams as juveniles for 2 to 3 years before migrating downstream to mainstem river sections (Goetz 1989). For example, in the Flathead River system, most juveniles outmigrate at age 2, with smaller percentages moving at ages 1 and 3 (Fraley and Shepard 1989). These migrations of juvenile bull trout can occur in spring, summer, or fall (Fraley and Shepard 1989; Pratt 1992; Hagen and Baxter 1992). Emigration from the spawning streams involves fry and 1+, 2+, and 3+ year juveniles (McPhail and Murray 1979). The majority of migrants to lakes are 2+ year juveniles (Chisholm et al. 1989).

Migratory bull trout can move large distances (more than 150 miles) among lakes, rivers, and tributary streams. They often congregate in large, slow pools to feed. After they reach larger rivers, bull trout can remain there for brief periods, or for as long as several years, before either moving into lakes or returning to tributary streams to spawn. During their river residency, bull trout commonly make long-distance annual or seasonal movements among various riverine habitats, apparently in search of foraging opportunities and refuge from warm, low-water conditions in mid-summer and ice in winter (Elle and Thurow 1994; Swanberg 1997).

Ideal temperatures for bull trout in migratory corridors are in the range of 10° to 12°C, but bull trout will migrate through waters with higher water temperatures, especially those with cold-water refugia available (Buchanan and Gregory 1997; Swanberg 1997). Adults migrate back to their natal tributaries to spawn, apparently with a high degree of fidelity (Swanberg 1997; Kanda et al. 1997).

In the late-spring/early summer, during periods of maximum stream flows, bull trout adults of the adfluvial life history form migrate out of lakes and into spawning streams (Pratt 1992). For example, migration from Flathead Lake into the Flathead River begins in April and peaks during the high flows of May and June (Shepard et al. 1994). Bull trout spawners move upriver slowly, and may spend weeks or months holding at the mouths of spawning tributaries prior to the actual spawning run. Once suitable stream temperatures are reached, usually mid-to late September, the adult bull trout ascend the tributaries and spawn. After spawning, bull trout move out of the tributaries and back down into the lower river and lake.

Bull trout require migratory corridors that link seasonal habitats for all bull trout life histories. For example, in Montana, migratory bull trout make extensive migrations in the Flathead River system (Fraley and Shepard 1989), and resident bull trout in tributaries of the Bitterroot River move downstream to overwinter in tributary pools (Jakober 1995). The ability to migrate is important to the persistence of bull trout, as it facilitates gene flow among local populations and may help reestablish populations in an area where the local population of bull trout has been extirpated (Rieman and McIntyre 1993).

Bull trout are opportunistic feeders, and like many salmonids, they shift their diet as they grow. Prey include terrestrial and aquatic insects, macro-zooplankton, amphipods, mysids, crayfish, and small fish. As bull trout mature, they tend to rely less on invertebrates as their primary prey and may feed exclusively on fish, a strategy that allows lacustrine (lake dwelling) and large river populations to generally achieve larger body sizes than resident bull trout, as higher fish densities are generally present. Bull trout eat a wide variety of native and introduced species but appear to have a particular propensity for sculpins (*Cottus* sp.) (Pratt 1992), kokanee (a freshwater form of *Onchorynchus nerka*) (McPhail and Murray 1979; Bjornn 1961), and mountain whitefish (*Prosopium williamsoni*) (Chisholm et al. 1989; Donald and Alger 1993).

Individuals normally reach sexual maturity in 4 to 7 years and live as long as 12 years. Bull trout commonly grow up to lengths of 37 inches and weight up to 20 pounds. The size and age of bull trout at maturity depends on life history strategy, with resident fish tending to be smaller than migratory fish at maturity (Fraley and Shepard 1989; Goetz 1989).

3.1 CORRIDOR NEEDS

Habitat alteration has fragmented habitats, eliminated migratory corridors, and isolated bull trout in the headwaters of tributaries (Dunham and Rieman 1999; Rieman and Dunham 2000). Migratory corridors allow individuals access to unoccupied but suitable habitats, foraging areas, and refuges from disturbance.

Maintenance of migratory corridors for bull trout is essential to provide connectivity among local populations, and enables the re-establishment of extinct populations (Saunders et al. 1991).

Lack of connectivity has been identified as a major threat to restoration of bull trout in several watersheds in Montana. Connectivity in and among these watersheds is obstructed by a variety of factors, including dams, diversions, culverts, barriers, dewatering, and stretches of unsuitable or inhospitable habitat.

Frissell (personal communication) indicated that, although habitat fragmentation is an issue in Montana, it is not necessarily relevant to metapopulation concepts and that truncated life histories of bull trout have shown distinct genetic diversion between local populations. This implies that conservation is critical to maintain existing populations, because if a local population is impacted or extirpated, bull trout from a neighboring population may be unable to recolonize and act as a source of genetic diversity to the impacted population.

3.2 KEY BIOLOGICAL RELATIONSHIPS

This section describes biological relationships required by the subject species and does not include biological functions/roles that the subject species provides for other organisms (e.g. woodpeckers provide cavities for hole-nesting birds).

In the Columbia River Basin, bull trout can occur in the same drainage with native cutthroat trout (*O. clarki* subspecies), resident (redband) and migratory (steelhead) rainbow trout (*O. mykiss*), sockeye salmon (*O. nerka*), mountain whitefish, white sturgeon (*Acipenser transmontanus*), and various sculpin, sucker (*Catostomidae*), and minnow (*Cyprinidae*) species (Mauser et al. 1988; WDFW 1998).

In addition, nonnative salmonids have been widely introduced and have become established in numerous areas throughout the range of bull trout. These species include brook trout (*S. fontinalis*), lake trout (*S. namaycush*), brown trout (*Salmo trutta*), Arctic grayling (*Thymallus arcticus*), and lake whitefish (*Coregonus clupeaformis*). Kokanee, nonnative strains of rainbow trout, and nonnative subspecies of cutthroat trout have also been introduced into areas where they did not occur naturally.

Introduced brook trout threaten bull trout through hybridization, competition, and possibly predation (Leary et al. 1993; Rieman and Mclntyre 1993). Hybridization between brook trout and bull trout has been reported in Montana (MBTSG 1995a, e; MBTSG 1996d, f), resulting in offspring that are typically sterile (Leary et al. 1993). Because brook trout mature at an earlier age, have a higher reproductive rate, adapt better to degraded habitats, and tend to thrive in streams with higher water temperatures than bull trout, brook trout may outcompete bull trout when both species occur together. Brook trout can often replace bull trout (Leary et al. 1993; MBTSG 1995a; MBTSG 1996g). McDonald (personal communication) noted that correcting fish passage barriers for bull trout may negatively affect both bull and cutthroat trout by allowing for the introduction of brook trout in areas where they were previously excluded. Eastern brook trout can compete and hybridize with both species. The evaluation of fish passage barriers on a case-by-case basis with a particular emphasis on which native and nonnative fish species are present in the local area, should be considered.

Introduced brown trout are established in several areas within the range of bull trout and likely compete for food and space and prey on bull trout. Brown trout may compete for spawning and rearing areas and superimpose redds on bull trout redds. Elevated water temperatures may favor brown trout over bull trout in competitive interactions (MBTSG 1996g).

Nonnative lake trout (i.e., forms west of the Continental Divide) also negatively affect bull trout in lakes by limiting foraging opportunities and reducing the distribution and abundance of migratory bull trout

(Donald and Alger 1993; MBTSG 1996g). Fredenberg (2002) found that numbers of bull trout in lakes within Glacier National Park, Montana had decreased over the last few decades. This decrease was found only in lakes with populations of lake trout. The number of bull trout in lakes without lake trout (Quartz Lake) remained stable through time. Because of the lack of other variables commonly attributed to bull trout declines, this study infers that lake trout have had a substantial detrimental impact to bull trout in mountain lakes (Fredenberg 2002).

Nonnative northern pike (*Esox lucius*) and introduced bass also have the potential to negatively affect bull trout (MBTSG 1996f). Northern pike populations have increased in Salmon Lake and Lake Inez in Montana, resulting in a negative effect on bull trout due to competition (R. Berg In USFWS 2002). In the Clark Fork River, Montana, Noxon Rapids Reservoir supports fisheries for both smallmouth bass (*Micropterus dolomieui*) and largemouth bass (*M salmoides*).

The introduction of opossum shrimp (*Mysis relicta*) into lakes changes the trophic dynamics, and can result in expanding lake-trout populations and increased competition and predation on bull trout. In lakes without lake trout, the opossum shrimp may help to increase the availability of forage for bull trout, contributing to an increase in their numbers (MBTSG 1995c; MBTSG 1996f). The introduction of opossum shrimp in Flathead Lake changed the lake's trophic dynamics, and resulted in expanding lake trout populations, causing increased competition and predation on bull trout (MBTSG 1995c).

Some introduced species, such as rainbow trout and kokanee, may benefit large adult bull trout by providing supplemental forage. However, introduction of nonnative game fish can be detrimental resulting in increased angling and subsequent incidental catch and harvest of bull trout (Pratt 1992; MBTSG 1995c).

An extensive multiagency public and private campaign has been underway in Montana for over a decade to inform and educate the public about species identification and the values of bull trout and other native fish. Species misidentification by anglers poses a significant problem for bull trout recovery efforts.

4. SENSITIVITY TO COVERED ACTIVITIES

The following DNRC forest management activities are proposed for coverage under the habitat conservation plan (HCP). The sensitivity of a fish or wildlife species to these activities may depend on the time of year, duration and areal extent of the activity, distance of the activity from the subject species, screening vegetation or terrain, and in some cases, the previous exposure (habituation) of the individual to the activity. There are likely complex interactions between large woody debris (LWD) jams, groundwater upwelling, and sediment delivery that affect bull trout (Riggers, personal communication). These interactions, although difficult to research, may be very important in accurately assessing bull trout habitat and planning recovery efforts. Further research is also needed on the effects of natural disturbances (e.g., fires and floods) regarding scale issues, and how natural disturbances affect the habitat components for bull trout. Potential bull trout sensitivities to covered activities are described below.

4.1 TIMBER HARVEST

Timber management activities can be classified into two main categories: upland and riparian. The most important potential effects of upland timber management on bull trout and their habitat include reduced pool quality, habitat complexity, channel stability, and bank stability caused by increased peak flows; reduced substrate quality resulting from increased sediment delivery; increased water temperatures; reduced groundwater inflows produced through alteration of natural flow regimes; reduced connection between stream systems; and blockage of migratory corridors caused by channel aggradation (Chamberlin et al. 1991; Furniss et al. 1991; Waters 1995; USFWS 2002). These impacts are generally caused by sediment and erosion produced by road construction, maintenance, and use, which is often compounded by the loss of vegetation (from harvest) that filters and absorbs runoff and by increased sedimentation from increased surface runoff and soil erosion.

Potential effects on bull trout and their habitat from riparian timber harvest include increased summer stream temperatures due to the removal of shading vegetation; reduced LWD recruitment caused by the removal of source vegetation; reduced pool quality, habitat complexity, channel stability, and bank stability resulting from the removal of vegetation and bank erosion; and reduced substrate quality caused by increased sediment delivery. Disturbance events, including timber harvest, can affect bull trout in two ways (Frissell, personal communication). These are by changing habitat, or by reducing population size and diversity, either one of which negatively impact a local population.

4.2 SALVAGE HARVEST

Effects of salvage harvest on bull trout are similar to those for timber harvest, although impacts to riparian vegetation and stream shading are less, because many of the trees that are salvage harvested are already dead and do not provide significant amount of shade.

4.3 THINNING

Effects of thinning on bull trout are similar to those for timber harvest, although impacts to riparian vegetation and stream shading are less because pre-commercial thinning activities do not result in a similar level of tree removal, and the trees removed are non-merchantable trees.

4.4 CONTROL AND DISPERSAL OF SLASH

Mechanized means of slash dispersal have the potential to compact site soils and increase stream sedimentation and can negatively impact bull trout if these activities occur on steep slopes, or in areas immediately adjacent to a stream or upslope of a stream without a functioning riparian buffer. Broadcast burning or pile burning can also lead to a loss of nutrients on the site. Hydrologic cycles, infiltration rates, and groundwater recharge capabilities of the site can be altered, degrading stream flow.

4.5 PRESCRIBED BURNING

The effects of prescribed burning are similar to those discussed for control of slash. If prescribed burns escape, becoming an uncontrolled fire, a loss of riparian vegetation can result in increased stream temperatures, deleteriously affecting bull trout habitat.

4.6 SITE PREPARATION

Covered activities do not include herbicide applications, but include burning and scarification. The effects of prescribed burning are similar to those discussed for control of slash. Scarification can result in increased erosion and sediment delivery into streams, resulting in pool filling, redd entombment, and other deleterious effects to bull trout.

4.7 REFORESTATION

Reforestation activities would be expected to have a beneficial effect on bull trout. Reforestation increases slope stability and stream shading, and reduces the amount of surface and subsurface runoff into streams.

4.8 WEED CONTROL

Covered activities do not include herbicide applications, which can lead to direct effects on bull trout such as acute or chronic toxicity. Other weed control activities, such as replanting of disturbed areas with appropriate native vegetation, would be expected to have a beneficial effect to bull trout, due to increased stream shading and decreased stream sedimentation rates.

4.9 ROAD CONSTRUCTION

Roads constructed for forest management are a prevalent feature on managed forested and rangeland landscapes. Roads can change soil density, temperature, soil water content, light levels, dust, surface waters, patterns of runoff, and sedimentation, as well as adding pollutants (including heavy metals) and nutrients to roadside environments, which can include streams (Furniss et al. 1991; Baxter et al. 1999; Trombulak and Frissell 2000). Road construction, use, and maintenance have the potential to deleteriously affect fish migration (blocked culverts), spawning (changes to substrate and stream flow), incubation (increased sedimentation or scour), and juvenile rearing (decreased riparian vegetation and changes to prey base). Roads may affect aquatic habitats considerable distances away and the area occupied by a road can be small compared to the entire downstream area subjected to its effects (e.g. increases in sedimentation, debris flows, and peak flows affecting streams longitudinally) (Trombulak and Frissell 2000). An analysis of the relationship between road densities and bull trout status and distribution found that bull trout are less likely to use streams in highly roaded areas for spawning and rearing (Quigley and Arbelbide 1997). The USFWS Bull Trout Matrix (USFWS 1998c) considers road density, sediment, physical barriers, stream temperature, LWD frequency, and pool frequency as important indicators for the evaluation of bull trout habitat. All of these elements can be impacted by presence of roads in a watershed.

4.10 ROAD MAINTENANCE

The effects on bull trout from road maintenance activities are similar to those discussed for road construction. Sediment delivery from roads to streams is of primary concern. Road maintenance activities (such as road grading, sidecasting of road material, and use of roads in wet weather) can increase erosion and contribute sediment to streams, thereby deleteriously affecting bull trout.

4.11 FOREST INVENTORY

Forest inventory activities should not contribute to adverse effects on bull trout or bull trout habitat.

4.12 MONITORING

Watershed monitoring, as discussed in Section 8.1 of this species account is not expected to have adverse effects on bull trout or bull trout habitat. However, bull trout population monitoring could cause stress or mortality to individual bull trout if capture methods are used (e.g. electrofishing or netting). In general, BMP monitoring efforts will allow DNRC to implement BMPs that are effective in protecting bull trout and bull trout habitat, resulting in a net beneficial effect.

4.13 GRAZING OF CLASSIFIED FOREST LANDS

Livestock grazing effects on bull trout and their habitat include elevated water temperatures caused by increased insolation resulting from removal of overhanging vegetation and increased channel width; increased sedimentation from bank and upland erosion; decreased pool volume and quality caused by increased channel width and loss of bank undercut; and a decrease or absence of riparian vegetation caused by channel degradation, lowering of the water table, and soil compaction. Grazing practices have affected DNRC land west of the Continental Divide, especially where the grazing occurs on small isolated blocks of state land (Shepard, personal communication). If rest and rotation grazing strategies are not fully followed or implemented in areas where the only grazeable land is located in valley bottom meadows, long-term continual damage to the riparian zone, streambanks, and stream channel can result.

4.14 GRAVEL QUARRYING FOR THE PURPOSES OF LOGGING AND ROAD CONSTRUCTION

Gravel quarries, if constructed near streams, can contribute to increased sediment delivery into streams. Gravel quarries can deleteriously affect bull trout by causing physiological stress, altering aquatic habitat through pool filling and redd entombment, and potentially altering the forage base of adult and juvenile bull trout.

4.15 FERTILIZATION

Fertilizer, in the form of nitrogen, can produce materials toxic to fish, such as ammonia and nitrates, as fertilizer breaks down. In general, the smaller concentrations of these products in the water could lead to sublethal physiological and histopathological impacts rather than direct mortality. Another potential effect on bull trout habitat is the alteration of water chemistry (e.g. hardness).

4.16 ELECTRONIC FACILITY SITES

Since the electronic facility sites are generally located on ridgetops, the primary deleterious effects that may occur would be related to sedimentation from the construction of access roads (see Sections 4.9 and 4.10).

4.17 OTHER ACTIVITIES COMMON TO COMMERCIAL FOREST MANAGEMENT

Other activities, such as foot travel and fieldwork for DNRC controlled activities, should not contribute to adverse effects on bull trout.

5. MANAGEMENT NEEDS AND RECOMMENDATIONS

State and federal entities have investigated existing bull trout populations in Montana, and formulated general goals relating to the continued persistence of bull trout, and ultimately, their recovery. These entities, including USFWS, have also formulated general objectives with recommendations that will help achieve those goals. While these recommendations are not regulatory, DNRC has been a party to their development, and is committed to bull trout recovery. The goals and objectives are summarized below, while specific conservation measures developed by other entities are discussed in Section 6.

5.1 MONTANA BULL TROUT RESTORATION PLAN

The goal of the *Montana Bull Trout Restoration Plan* (MBTRT 2000) is to ensure the long-term persistence of complex (all life histories represented), interacting groups of bull trout distributed across the species range, and to manage for sufficient abundance within restored restoration/conservation areas (RCAs) to allow for recreational utilization.

- *Goal Objective 1: Protect existing populations within all core areas and maintain the genetic diversity represented by those remaining local populations.*
- *Goal Objective 2: Maintain and restore connectivity among historically connected core areas.*
- *Goal Objective 3: Restore and maintain connectivity between historically connected RCAs.*
- *Goal Objective 4: Develop and implement a statistically valid population monitoring program.*

MBTRT (2000) defined specific causes of decline in each of three general categories (habitat, fisheries, and population management). Recommendations for the type of actions that should be reviewed and addressed in each bull trout watershed include:

Habitat Management

- *protect core and nodal habitats from additional degradation,*
- *restore degraded bull trout habitat to meet the requirements of bull trout,*
- *adopt land management guidelines and practices that maintain or improve important bull trout habitat processes,*
- *maintain/restore physical integrity of habitat,*
- *reduce point and nonpoint pollution,*
- *determine effectiveness of existing habitat protection regulations and BMPs,*
- *restore and maintain natural hydrologic conditions (flow, timing, duration), and*
- *operate dams to minimize impacts.*

Fisheries Management

- *implement angling regulations to prevent overharvest and minimize incidental catch of bull trout,*
- *educate anglers about fishing regulations and proper identification of bull trout,*
- *develop/implement fish stocking policies,*
- *develop/implement fish management goals that emphasize bull trout in core areas,*

- *where feasible, suppress or eradicate introduced species that compete with, hybridize with, or prey on bull trout,*
- *limit scientific collection of bull trout,*
- *regulate collection methods,*
- *regulate private ponds/preclude stocking of fish that compete with, prey on, or hybridize with bull trout in bull trout watersheds,*
- *monitor and prevent spread of fish diseases, and*
- *prevent illegal introductions of nonnative aquatic flora and fauna.*

Population/Genetics Management

- *maintain sufficient population size in watersheds,*
- *prevent hybridization with brook trout,*
- *maintain/restore connectivity between populations - prevent fragmentation,*
- *determine genetic baselines in each watershed,*
- *maintain locally adapted, genetically pure populations,*
- *manage populations (numbers and life forms) for long-term viability, and*
- *develop fish stocking and reintroduction policy for bull trout.*

5.2 DRAFT BULL TROUT RECOVERY PLAN

The goal of the *Draft Bull Trout Recovery Plan* (USFWS 2002) is "*to ensure the long-term persistence of self-sustaining, complex interacting groups of bull trout distributed across the species native range so that the species can be delisted"*. To accomplish this goal, the USFWS developed the following four objectives:

- *maintain current distribution of bull trout within core areas and restore distribution where recommended (in USFWS 2002 recovery unit chapters);*
- *maintain stable or increasing trends in abundance of bull trout, as defined by individual recovery units;*
- *restore and maintain suitable habitat conditions for all bull trout life history stages and strategies; and*
- *conserve genetic diversity and provide opportunity for genetic exchange.*

Recovery criteria, which address quantitative measurements of bull trout distribution, population characteristics, and threats that are linked to recovery objectives, were developed on a recovery unit basis. The current status of bull trout was evaluated based on four population elements. The four elements were: (1) number of local populations, (2) adult abundance, (3) productivity, or the reproductive rate of the population, and (4) connectivity (USFWS 2002).

USFWS (2002) suggested recovery measures for bull trout consisting of a hierarchical listing of actions. The following are a summary of general recovery tasks recommended by USFWS. Details on recovery measures and tasks specific to individual recovery units are contained in the *Draft Bull Trout Recovery Plan* (USFWS 2002).

Protect, restore, and maintain suitable habitat conditions for bull trout.

- *Maintain or improve water quality in bull trout core areas or potential core habitat.*
- *Identify barriers or sites of entrainment for bull trout and implement tasks to provide passage and eliminate entrainment.*
- *Identify impaired stream channel and riparian areas and implement tasks to restore their functions.*
- *Operate dams to minimize negative effects on bull trout in reservoirs and downstream.*
- *Identify upland conditions negatively affecting bull trout habitats and implement tasks to restore appropriate functions.*

Prevent and reduce negative effects of nonnative fishes and other nonnative taxa on bull trout.

- *Develop, implement, and enforce public and private fish stocking policies to reduce stocking of nonnative fishes that affect bull trout.*
- *Evaluate enforcement policies for preventing illegal transport and introduction of nonnative fishes.*
- *Provide educational opportunities to the public about ecosystem effects of introductions of nonnative fishes.*
- *Evaluate biological, economic, and social effects of control of nonnative fishes.*
- *Develop tasks to reduce negative effects of nonnative taxa on bull trout.*
- *Implement control of nonnative fishes where found to be feasible and appropriate.*

Establish fisheries management goals and objectives compatible with bull trout recovery, and implement practices to achieve goals.

- *Develop and implement State and Tribal native fish management plans integrating adaptive research.*
- *Evaluate and prevent overharvest and incidental angling mortality of bull trout.*
- *Evaluate potential effects of nonnative fishes and associated sport fisheries on bull trout recovery and implement tasks to minimize negative effects on bull trout.*
- *Evaluate effects of existing and proposed sport fishing regulations on bull trout.*

Characterize, conserve, and monitor genetic diversity and gene flow among local populations of bull trout.

- *Incorporate conservation of genetic and phenotypic attributes of bull trout into recovery and management plans.*
- *Maintain existing opportunities for gene flow among bull trout populations.*
- *Develop genetic management plans and guidelines for appropriate use of transplantation and artificial propagation.*

Conduct research and monitoring to implement and evaluate bull trout recovery activities, consistent with an adaptive management approach using feedback from implemented, site-specific recovery tasks.

- *Design and implement a standardized monitoring program to assess the effectiveness of recovery efforts affecting bull trout and their habitats.*
- *Conduct research that evaluates relationships among bull trout distribution and abundance, bull trout habitat, and recovery tasks.*
- *Conduct evaluations of the adequacy and effectiveness of current and past best management practices in maintaining or achieving habitat conditions conducive to bull trout recovery.*
- *Evaluate effects of diseases and parasites on bull trout, and develop and implement strategies to minimize negative effects.*
- *Develop and conduct research and monitoring studies to improve information concerning the distribution and status of bull trout.*
- *Identify evaluations needed to improve understanding of relationships among genetic characteristics, phenotypic traits, and local populations of bull trout.*

Use all available conservation programs and regulations to protect and conserve bull trout and bull trout habitats.

- *Use partnerships and collaborative processes to protect, maintain, and restore functioning core areas for bull trout.*
- *Use existing Federal authorities to conserve and restore bull trout.*
- *Enforce existing Federal, State, and Tribal habitat protection standards and regulations and evaluate their effectiveness for bull trout conservation.*

Assess the implementation of bull trout recovery by recovery units, and revise recovery unit plans based on evaluations.

- *Convene annual meetings of each recovery unit team to review progress on recovery plan implementation.*
- *Assess effectiveness of recovery efforts.*
- *Revise scope of recovery as suggested by new information.*

5.3 BULL TROUT INTERIM CONSERVATION GUIDANCE

The following section contains a partial list of recommended actions by the USFWS as described in the document *Bull Trout Interim Conservation Guidance* (USFWS 1998b). USFWS lists two overall objectives that guided development of the Habitat and Management issues:

1. *Preserve or restore connectivity among bull trout subpopulations and their habitats through habitat restoration or protection.*
2. *Restore and conserve natural ecosystem processes to improve or protect habitat, thereby expanding abundance, distribution, and diversity of life-history forms (i.e., fluvial or river dwelling, adfluvial or lake dwelling, resident, and anadromous).*

The following list of selected recommended actions addresses those actions most pertinent to activities that will be addressed by this project. The list is divided into groups based on the individual habitat components that the specific recommended actions address.

Stream Temperature Related Recommended Actions

- *Restrict harvest or management activities that reduce shade below 100 percent, or below the level of shade necessary for maintaining cold water in both fish bearing or non-fish bearing streams, including headwaters.*
- *Protect sources and prevent alteration of groundwater flow by limiting new withdrawals and maintaining or restoring historic groundwater flows in both the floodplain and deep aquifer. Avoid all management activities that may alter groundwater input to spawning and rearing streams, such as draining or filling wetlands or placing roads in sensitive sites, such as seeps and springs.*
- *Modify activities in both riparian and upland areas that alter flow regimes and may indirectly cause water temperatures to exceed optimal or preferred temperatures of bull trout.*

Habitat Complexity Related Recommended Actions

- *Identify areas minimally affected by land management activities, and evaluate riparian and channel processes and structure to serve as a reference for similar geomorphic areas altered by land management activities.*
- *Maintain or restore natural bank characteristics (riparian vegetation, woody debris, sinuosity), solid structures (boulders, LWD), and instream channel characteristics (large pools, side channels) that are needed for floodplain and channel function across all land ownerships.*
- *Identify areas where roads, railroads, bridges, or culverts restrict floodplain and channel functions and habitat complexity, and utilize information in the development of a watershed transportation plan.*
- *Provide adequate riparian buffers to filter sediment from management activities.*
- *Identify and repair, relocate, or remove roads that contribute significantly to sediment input.*
- *Provide for recruitment of woody debris from both occupied and upstream areas (including non-fish bearing and intermittent streams).*

Habitat Connectivity Related Recommended Actions

- *Protect current bull trout refugia and avoid activities or effects that would further fragment habitat, reduce habitat patch size, or further isolate remaining bull trout subpopulations.*
- *Maintain or improve connectivity along occupied habitats and refugia by removing human-caused physical, thermal, and chemical barriers within and among isolated subpopulations in areas not at risk of invasion by non-native species.*
- *Restore occupiable habitat, particularly in low gradient unconstrained channels that often serve as migratory corridors or seasonal habitats for specific life history stages of bull trout.*

Stream Substrate and Channel Stability Related Recommended Actions

- *Identify and modify land management activities (upland and riparian) that have the potential to contribute sediment to spawning and rearing areas above natural levels to prevent elevated levels of sediment.*
- *Identify and modify land management activities (upland and riparian) that have the potential to reduce pocket waters and pools in rearing habitat.*

- *Maintain or restore natural surface flows and local runoff patterns in order to avoid unnatural bedload movements as a result of extreme peak flows or formation of anchor ice.*

Roads Related Recommended Actions

- *Avoid new road construction in areas vulnerable to mass wasting and in areas that may initiate or exacerbate stream bank erosion.*
- *Identify, repair, remove, or relocate roads that negatively affect riparian processes (vegetative cover, LWD, particulate organic matter input, hydraulic processes).*
- *Avoid activities that directly alter the streambed in spawning areas.*
- *Provide adequate amounts of woody debris to capture instream sediment and trap spawning gravels.*
- *Restore floodplain and habitat connectivity by removing physical barriers to migration caused by roads, culverts, fords, and crossings and maintain or restore hydrologic processed and floodplain functions.*
- *Maintain unroaded portions of bull trout watersheds in current roadless condition.*
- *If new road construction is planned within a bull trout watershed, strive to attain a road restoration/construction ratio that will reduce road densities.*

Floodplain and Riparian Protection Related Recommended Actions

- *Limit activities within the channel migration zone or 100-year floodplain to those that have either a neutral or beneficial effect on floodplain functions.*
- *Measure riparian buffer strips beginning at the outer edge of the channel migration zone or 100-year floodplain, whichever is greater, and use horizontal distance measurements.*

6. CURRENT DNRC PROTECTIVE MEASURES

The most directly applicable regulations governing management of bull trout on DNRC State forest trust lands include the *Administrative Rules of Montana* (ARM) under Sub-Chapter 4 for State Forest Land Management and sections from Best Management Practices for Forestry in Montana, including those regulations for Streamside Management Zones (SMZs). These laws and rules were implemented to protect streams, wetlands, and watersheds from the deleterious effects of timber harvest, and associated activities, such as road building. The primary features of these rules are to restrict the scope and range of activities that may pose a threat to aquatic habitat and species, including bull trout.

6.1 ADMINISTRATIVE RULES OF MONTANA (ARM)

The following sections of the ARM are those under Sub Chapter 4 that relate to State Forest Land Management (DNRC 2003a). The rules concerning bull trout are listed below, with the exact wording of the ARM in italicized text. Summary comments, in regular text, follow each individual rule subsection.

36.11.421 ROAD MANAGEMENT

(1) The department shall plan transportation systems for the minimum number of road miles.

(a) The department shall only build roads that are necessary for current and near-term management objectives, as consistent with the other forest management rules.

(b) The department shall evaluate and use alternative yarding systems that do not require roads whenever possible.

(2) The department shall conduct transportation planning as part of landscape-level evaluations. The department shall also conduct an evaluation of existing and possible future transportation systems prior to road location and design. When planning transportation, the department shall consider:

(a) the relationship of access routes and road systems on adjacent sections, regardless of ownership. Managers shall plan systems cooperatively with adjacent landowners whenever practicable to minimize road construction.

(b) planning road systems cooperatively with adjacent landowners whenever practicable to minimize road construction.

(c) existing and probable future management needs of the tributary area, such as:

(i) coordination of department needs with adjacent ownership needs;

(ii) public access;

(iii) logging system capabilities;

(iv) forest improvement activities;

(v) fire protection; and

(vi) wildlife habitat protection.

(d) value(s) of resources being accessed for the proposed project as well as resources to be accessed from future road construction, road use or extension of transportation system.

(3) When planning the location, design, construction, and maintenance of all roads, the department shall:

- (a) *comply with BMP as necessary to avoid unacceptable adverse impacts or as funding is available to implement improvements to existing roads;*
- (b) *build roads to the minimum standard necessary to best meet current and future management needs and objectives;*
- (c) *manage roads to minimize maintenance;*
- (d) *relocate existing roads if reconstruction, maintenance and/or use of existing roads would produce greater undesirable impacts than new construction; and*
- (e) *use existing roads in SMZ only if potential water quality impacts can be adequately mitigated. The department shall primarily consider economic and watershed implications of relocating roads outside the SMZ.*

(4) *The department shall write contract specifications and administer construction projects to ensure roads are built as designed and to meet resource protection requirements.*

(5) *The department shall maintain roads commensurate with expected road use and appropriate resource protection.*

(6) *The department shall also maintain drainage structures and other resource protection measures on both restricted and open roads.*

(7) *The department shall include adequate maintenance requirements, proportional to road use, in all agreements for granting and acquiring rights-of-way, and the requirements shall be enforced during the administration of those agreements.*

(8) *The department shall plan road density to satisfy project level objectives, landscape-level plans and other forest management rules.*

(9) *The department shall determine which roads to close, abandon, or obliterate during project level analysis.*

(10) *The department shall consider closure or abandonment of roads accessible to motorized vehicles:*

- (a) *that are non-essential to near-term future management plans; or*
- (b) *where unrestricted access would cause excessive resource damage.*
    - (i) *In the Swan River state forest, the department shall plan road closures in accordance with the terms of the Swan Valley Grizzly Bear Conservation Agreement, dated February 23, 1995.*

(11) *The department shall consider for abandonment roads that are deemed non-essential. The department shall leave abandoned roads in a condition that provides adequate drainage and stabilization, while leaving intact the road prism and capital investment needed to construct that road.*

(12) *The department shall assess road maintenance needs by inspecting conditions on both open and closed roads every five years. The department shall then prioritize maintenance operations considering the results of the inspections.*

(13) *The department shall inspect existing road systems during the planning and review of proposed timber sales and other projects. The inspections are intended to provide information used for:*

- (a) *road planning;*
- (b) *construction and maintenance; and*

(c) giving an opportunity for the correction of problem areas by incorporating corrective measures into planned projects.

(14) The department shall inspect road closure structures, such as gates and earth berms, as part of ongoing administrative duties and in response to notice of ineffective road closures received from the public. The department shall repair or modify ineffective closures or consider alternative methods of closure. Inspections would occur at least every five years. Repairs would be a high priority when allocating time and budget. (History: 77-1-202, 77-1-209, 77-5-201, 77-5-204, MCA; IMP, 77-5-116, 77-5-204, 77-5-206, 77-5-207, MCA; NEW, 2003 MAR p. 397, Eff. 3/14/03.)

The preceding rules are intended to minimize the number and extent of roads (Rule 1), as well as to evaluate the road program (Rule 2), including the practice of road abandonment/obliteration (Rules 9, 10, and 11), where appropriate. Other rules critical for the protection of bull trout in this section include 3a (adherence to BMPs) and 3e (roads located within the SMZ). Rule 12 requires a monitoring effort every 5 years.

36.11.422 WATERSHED MANAGEMENT

(1) The department shall manage watersheds to maintain high quality water that meets or exceeds state water quality standards and protects designated beneficial water uses.

(2) The department shall incorporate BMP's into the project design and implementation of all forest management activities.

(a) BMP's appropriate for a given project or situation shall be determined during project development and environmental analysis. (History: 77-1-202, 77-1-209, 77-5-201, 77-5-204, MCA; IMP, 77-5-116, 77-5-204, 77-5-206, 77-5-207, MCA; NEW, 2003 MAR p. 397, Eff. 3/14/03.)

DNRC considers a primary beneficial use (Rule 1) to be the protection of coldwater fish species, including bull trout. Some appropriate BMPs (Rule 2) are listed at the end of this section.

36.11.423 WATERSHED MANAGEMENT – CUMULATIVE EFFECTS

(1) The department shall include an assessment of cumulative watershed effects on projects involving substantial vegetation removal or ground disturbance. Using the analysis, the department shall ensure that the project will not increase impacts beyond the physical limits imposed by the stream system for supporting its most restrictive beneficial use(s), when considered with other existing and proposed state activities for which the scoping process has been initiated. The analysis shall identify opportunities, if any exist, for mitigating adverse effects on beneficial water uses.

(a) The department shall determine the necessary level of cumulative watershed effects analysis on a project level basis. The level of analysis shall depend on the:

(i) extent of the proposed activity;

(ii) level of past activities; and

(iii) beneficial uses at risk.

(b) The department shall complete a coarse filter screening on all projects involving substantial vegetation removal or ground disturbance. Except for small-scale projects with very low potential for impacts, additional analysis shall be required.

(c) The department shall complete a preliminary watershed analysis on projects when coarse filter evaluations determine there is anything other than low potential for cumulative impacts.

(d) The department shall complete a detailed watershed analysis when coarse filter screening or preliminary analysis predict or indicate the existence of unacceptable cumulative watershed effects as a result of the proposal.

(e) The department shall establish threshold values for cumulative watershed effects on a watershed level basis.

(f) The department shall determine thresholds for cumulative watershed effects by taking into account such items as:

(i) stream channel stability;

(ii) beneficial water uses; and

(iii) existing watershed conditions.

(iv) The department shall set threshold values at a level that ensures compliance with water quality standards and protection of beneficial water uses with a low to moderate degree of risk.

(g) The department shall set threshold values for cumulative effects associated with projects proposed in the watershed of a water quality limited water body at a level that provides for protection of beneficial water uses with a low degree of risk.

(2) Whenever feasible, the department shall cooperate with other landowners in watersheds with mixed ownership to minimize cumulative watershed effects within acceptable levels of risk. (History: 77-1-202, 77-1-209, 77-5-201, 77-5-204, MCA; IMP, 77-5-116, 77-5-204, 77-5-206, 77-5-207, MCA; NEW, 2003 MAR p. 397, Eff. 3/14/03.)

DNRC considers a primary beneficial use (Rule 1[a] [iii]) to be the protection of coldwater fish species, including bull trout. A project that could affect bull trout waters is more likely to have a more detailed cumulative watershed effects analysis and a more conservative threshold value (Rule 1 [f]) than a project not affecting watersheds containing native coldwater fish.

36.11.424 WATERSHED MANAGEMENT – MONITORING

(1) The department shall develop and maintain a monitoring strategy to assess watershed impacts of land use activities and the effectiveness of mitigation measures. The monitoring strategy shall include:

(a) qualitative assessments, such as BMP audits, on most projects with a substantial amount of soil disturbance. For future applications, the department shall revise BMP's that fail to provide adequate protection;

(b) site-specific monitoring projects using quantitative assessment methods on selected sites to determine the effectiveness of BMP's and other commonly applied mitigation measures;

(c) assessments of habitat conditions on selected streams identified as supporting the fish species listed as threatened or endangered under the Endangered Species Act, 16 U.S.C. Sections 1531 through 1544, and sensitive fish species;

(d) evaluations of the effects of forest management activities on soils at selected sites; and

(e) an inventory and analysis of watershed impacts on state trust lands as funding allows.

(i) If conducted, the analysis shall be sufficient to identify causes of watershed degradation and set priorities for watershed restoration. The department shall emphasize mitigation of existing water quality impacts in order to provide greater opportunities to produce trust income while maintaining beneficial uses.

(2) If watershed, soil, or fisheries monitoring indicate unacceptable impacts resulting from forest management activities, the department shall attempt to verify the problem, and correct or mitigate it to an acceptable level. When necessary, the department shall use the information collected to revise mitigation measures and/or modify future activities to avoid similar problems.

(3) The department shall participate in cooperative watershed monitoring effort with other agencies, public entities and private parties, where practical, when funding is available, and when the cooperative monitoring objectives are consistent with department monitoring objectives. (History: 77-1-202, 77-1-209, 77-5-201, 77-5-204, MCA; IMP, 77-5-116, 77-5-204, 77-5-206, 77-5-207, MCA; NEW, 2003 MAR p. 397, Eff. 3/14/03.)

Monitoring by DNRC has primarily included extensive use of project-level monitoring efforts that are qualitative in nature (site inspections, audits, and ocular estimates), although some more detailed site-specific quantitative monitoring efforts are also underway, including long-term cooperative monitoring efforts (see Section 8). Rule 2 should be considered as an adaptive management approach.

36.11.425 WATERSHED MANAGEMENT – STREAMSIDE MANAGEMENT ZONES AND RIPARIAN MANAGEMENT ZONES

(1) The department shall establish a riparian management zone (RMZ) adjacent to the minimum width of the SMZ required under ARM 36.11.302 when forest management activities are proposed on sites with high erosion risk or on sites that are adjacent to fish bearing streams or lakes.

(2) The department shall determine the presence of high erosion risk from:

(a) established soil surveys;

(b) existing inventories; or

(c) site-specific field evaluations.

(3) When the department proposes forest management activities on sites determined to have high erosion risk:

(a) the department shall establish an RMZ with a minimum of 100 feet when activities are located on slopes greater than 25% but less than 35%;

(b) the department shall establish an RMZ with a minimum of 150 feet when activities are located on slopes greater or equal to 35%, but less than 50%;

(c) the department shall establish an RMZ with a minimum of 200 feet when forest management activities are located on slopes greater or equal to 50%; and

(d) the department may modify and shorten RMZ widths established for high erosion risk when topographic breaks, existing roads or other factors are present that reduce erosion risk and provide suitable sediment delivery filtration. Modified or shortened RMZ's must still meet the minimum width of the SMZ required under ARM 36.11.302.

(4) The following restrictions apply to forest management activities conducted within an RMZ established for high erosion risk:

(a) The department shall limit new road construction within an RMZ to situations in which:

(i) a stream crossing is required;

(ii) potential impacts can be adequately mitigated; or

(iii) alternative locations pose higher risk of resource impacts.

(b) The department shall restrict ground based equipment operations within the RMZ.

(i) The department shall not allow the operation of wheeled or tracked equipment within an RMZ when it is located on slopes greater than 35%.

(ii) The department shall not allow the operation of wheeled or tracked equipment within an RMZ when it is located on slopes less than 35%, unless the operation can be conducted without causing excessive compaction, displacement or erosion of the soil.

(iii) The department may allow the use of wheeled or tracked equipment inside of that portion of an SMZ or RMZ when operated from an established road on the side of the road away from the stream pursuant to ARM 36.11.304.

(c) The department shall restrict cable yarding of logs within and across an RMZ to cable systems and operations that do not cause excessive ground disturbance within the SMZ or RMZ.

(5) The department shall design harvest prescriptions conducted in SMZ's and RMZ's located adjacent to fish bearing streams to retain adequate levels of shade and potential large woody debris recruitment to the stream channel by:

(a) establishing an RMZ that when combined with the SMZ has a minimum slope distance equal to the site potential tree height of the proposed harvest stand at age 100 years;

(b) determining site potential tree height from site index curves developed for local or regional forest types; and

(c) determining site index of a stand by measuring tree height and age directly from suitable index trees located at the approximate minimum SMZ width.

(6) The department shall determine adequate levels of shade retention on a project level basis.

(a) Adequate levels are those levels that maintain natural water temperature ranges.

(7) The department shall determine adequate levels of large woody debris retention on a project level basis.

(a) Adequate levels are those levels that maintain stream channel form and function.

(8) The department shall retain all bank edge trees on timber harvests conducted adjacent to streams.

(9) Timber harvests within the SMZ and RMZ of a stream, lake, or other body of water supporting bull trout or any other fish or aquatic species listed under the Endangered Species Act, 16 U.S.C Sections 1531 through 1544, the department shall act pursuant to ARM 36.11.427.

(10) The department shall use existing roads in the SMZ or RMZ only if potential water quality impacts are adequately mitigated and beneficial uses are fully protected. (History: 77-1-202, 77-1-209, 77-5-201, 77-5-204, MCA; IMP, 77-5-116, 77-5-204, 77-5-206, 77-5-207, MCA; NEW, 2003 MAR p. 397, Eff. 3/14/03.)

It was the intention of DNRC that the widths of a riparian management zone (RMZ), as listed in Rule 3a through c, be defined as the total width including the SMZ. The current wording of Rule 1 and 3 of this section indicates that the RMZs established in Rule 3 are in addition to the SMZ. The existing language in the rule represents an error in the Rules (G. Frank, 2003b, personal communication). Additional protection of the RMZ (Rule 1) applies only to sites with high erosion risk or on sites that are adjacent to fish-bearing streams or lakes. The establishment of an RMZ along fish-bearing streams is based on site potential tree height (Rule 5 [a through c)]). Modifying harvest prescriptions in these areas will retain levels of shade and potential LWD recruitment to the stream channel that are adequate. The adequacy of the shade levels are defined as those that meet natural water temperature ranges (Rule 6). Adequate LWD retention is based on the amount necessary for maintaining the stream channel form and function. Rule 5 does not apply to road building or other harvest activities (e.g., skidding or cable yarding).

36.11.426 WATERSHED MANAGEMENT – WETLAND MANAGEMENT ZONES

(1) The department shall establish a wetland management zone (WMZ) when forest management activities are proposed within or adjacent to an isolated wetland or adjacent to a wetland found within an SMZ.

(a) For isolated wetlands greater than 0.25 acre the WMZ boundary shall be 50 feet.

(b) For isolated wetlands smaller than 0.25 acre the WMZ boundary shall only include the wetland itself.

(c) For wetlands found within a SMZ, the WMZ boundary shall be 50 feet.

(2) The department shall meet all requirements of ARM 36.11.301 through 36.11.312 when conducting forest management activities within wetlands that are located within or intercepting an SMZ boundary.

(3) The criteria the department will use to identify wetlands are:

(a) plant species composition;

(b) soil characteristics; or

(c) depth of water table

(4) The presence of one or more field indicators for any of the three following criteria shall be adequate for wetland designation:

(a) The department shall consider a site to meet the wetland plant species composition criteria for wetland identification if, under normal circumstances, more than 50% of the dominant plant species from all strata occupying the site are classified as:

(i) obligate wetland;

(ii) facultative wetland; or

(iii) facultative species.

(b) The department shall consider a site to meet the wetland hydrology criteria if the area is:

(i) inundated either permanently or periodically to a depth at which emergent vegetation interfaces with open water; or

(ii) the soil has a frequently occurring high water table that remains within 12 inches of the surface for more than 14 consecutive days during the growing season of the prevalent vegetation.

(c) The department shall consider a site to meet the criteria for wetland soils if the soils occupying the site are classified as hydric soils.

(5) The department shall avoid the use and construction of roads in a WMZ.

(a) The department shall use existing roads or construct roads in a WMZ only if potential water quality impacts are adequately mitigated and wetland functions are maintained.

(6) The department shall restrict harvest and equipment operations within a WMZ.

(a) The department shall limit harvest and equipment operations within a WMZ to low-impact harvest systems and operations that do not cause:

(i) excessive compaction;

(ii) displacement; or

(iii) erosion of the soil.

(b) The department shall limit operation of ground-based equipment in a WMZ to periods of:

(i) low soil moisture;

(ii) frozen soil; or

(iii) snow covered ground conditions.

(c) Where ground based skidding through an isolated wetland is necessary, the department shall minimize the number of skidding routes and the number of passes.

(d) The department shall restrict cable yarding of trees from within a WMZ to systems that fully suspend harvested logs; or partially suspend logs when conducted during periods of:

(i) low soil moisture;

(ii) frozen soil; or

(iii) snow covered ground conditions.

(7) The department shall design harvest prescriptions in a WMZ to protect and retain shrubs and sub-merchantable trees. (History: 77-1-202, 77-1-209, 77-5-201, 77-5-204, MCA; IMP, 77-5-116, 77-5-204, 77-5-206, 77-5-207, MCA; NEW, 2003 MAR p. 397, Eff. 3/14/03.)

Rules 3 and 4 indicate that DNRC uses a functional assessment to characterize wetlands. Where any of the indicators are present—wetland vegetation, hydric soils, or wetland hydrology—the area is considered a wetland and Rules 1, 2, 5, 6, and 7 apply, as required. This approach is more conservative than the U.S. Army Corps of Engineers Section 404 Clean Water Act permit requirements, which require all three indicators to be present.

36.11.427 FISHERIES

(1) The department shall minimize impacts to fish populations and habitat by implementing the watershed, SMZ, and WMZ rules contained in ARM 36.11.422 through 36.11.426.

(2) The department shall review forest management activities proposed adjacent to streams, lakes, or other bodies of water supporting bull trout or other fish and aquatic species listed as threatened or endangered under the Endangered Species Act, 16 U.S.C. Sections 1531 through 1544, pursuant to ARM 36.11.404 through 36.11.428.

(a) The department shall make reasonable efforts, in its sole discretion, to cooperate in the implementation of conservation strategies developed by the state of Montana and USFWS for the restoration and recovery of bull trout and other listed fish species.

(i) The department shall design forest management activities to protect bull trout habitat by implementing conservation strategies pursuant to The Restoration Plan for Bull Trout in the Clark Fork River Basin and Kootenai River Basin, Montana (June 2000).

(3) As designated by the department, pursuant to ARM 36.11.436 the department shall:

(a) design forest management activities to protect and maintain:

(i) westslope cutthroat trout;

(ii) Yellowstone cutthroat trout;

(iii) artic grayling; and

(iv) all other sensitive fish and aquatic species.

(b) manage habitat supporting fish and aquatic species designated by the department as sensitive in a manner that complies with other rules concerning sensitive species.

(c) make reasonable efforts to cooperate in the implementation of state conservation strategies for the protection of:

(i) westslope cutthroat trout;

(ii) Yellowstone cutthroat trout;

(iii) artic grayling; and

(iv) other fish species designated as sensitive by the department, as is practicable.

(4) When installing new stream crossing structures on fish-bearing streams, the department shall provide for fish passage as specified in 83-5-501, MCA, the Stream Protection Act (124 permits). (History: 77-1-202, 77-1-209, 77-5-201, 77-5-204, MCA; IMP, 77-5-116, 77-5-204, 77-5-206, 77-5-207, MCA; NEW, 2003 MAR p. 397, Eff. 3/14/03.)

Rule 2 guides DNRC to reasonable cooperation in State and federal strategies for the restoration and recovery of bull trout, including the implementation of conservation measures as outlined in MBTRT (2000).

36.11.428 THREATENED AND ENDANGERED SPECIES

(1) The department shall participate in recovery efforts of threatened and endangered plant and animal species. The department shall confer in its sole discretion with the United States Fish and Wildlife service (USFWS) to develop habitat mitigation measures.

(a) Measures may differ from federal management guidelines because the department plays a subsidiary role to federal agencies in species recovery. In all cases, measures to support recovery must be consistent with department responsibilities under the Endangered Species Act and Trust Law. The department shall work with the USFWS to amend such measures when, in the judgment of the forest management bureau chief, they are inconsistent with trust management obligations.

(b) Measures to support species recovery shall be periodically updated to implement new biological information and legal interpretations as warranted.

(2) The department shall, in its sole discretion, participate on interagency working groups established to develop guidelines and implement recovery plans for threatened and endangered species.

(a) If additional plant or animal species with habitat on state trust lands are federally listed as threatened or endangered, the department shall, in its sole discretion, participate in working groups for those species.

(b) The department shall, in its sole discretion, also participate in interagency groups formed to oversee management of recently de-listed species.

(3) The department staff shall report sightings of threatened and endangered species, except bald eagles, to respective working groups or an appropriate data repository.

(a) For bald eagles, only new nest locations shall be reported. (History: 77-1-202, 77-1-209, 77-5-201, 77-5-204, MCA; IMP, 77-5-116, 77-5-204, 77-5-206, 77-5-207, MCA; NEW, 2003 MAR p. 397, 2003 MAR p. 397, Eff. 3/14/03.)

These laws and rules, in conjunction with the SMZ and BMPs discussed below, were implemented to protect streams, wetlands, and watersheds from the deleterious effects of timber harvest, and associated activities, such as road building. The primary features of these are to restrict the scope and range of activities that may pose a threat to aquatic habitat and species, including bull trout.

6.2 STREAMSIDE MANAGEMENT ZONES

The Streamside Management Law (77-5-301 through 307 *Montana Code Annotated* [MCA]) and administrative rules adopted under the SMZ Law provides minimum regulatory standards for forest practices in SMZs. This law prohibits activities that pose a threat to water quality, soils, or fish and wildlife habitat. Included are: broadcast burning; operation of wheeled or tracked vehicles (except on established roads); clearcutting; road construction, except when necessary to cross a stream or wetland; storage, use or disposal of hazardous wastes in a manner that pollutes streams, lakes or wetlands; or dumping gravel, dirt, rocks or logging slash into streams, wetlands or watercourses. The *Montana Guide to the Streamside Management Zone and Rules* is an excellent information source describing management opportunities and limitations within SMZs. Brief summaries of the rules are provided below.

SMZ widths are directly dependent on SMZ-slope and stream class. Stream classes are defined as:

- *Class 1 stream segments: Support fish or do not support fish, but flow at least six months of the year, and contribute surface flow to another stream, lake, reservoir or pond covering an area greater than one-tenth of an acre.*
- *Class 2 stream segments: Do not support fish, but do contribute flow to another stream, lake, reservoir or pond covering at least one-tenth of an acre; and flow for less than six months; or, do not contribute surface flow to another stream, lake reservoir or pond, but do flow at least six months of the year.*
- *Class 3 stream segments: Have no fish, rarely contribute surface flow to another body of water and normally do not flow more than six months of the year.*

Table 2 lists the required SMZ of each type of waterbody, as well as the requirements for leave trees within the SMZ. Clearcutting is prohibited within the SMZ.

Table 2. SMZ Widths for Various Stream Types and Lakes.

Waterbody Type	SMZ width (ft) if slope is less than or equal to 35%[a]	SMZ width (ft) if slope is greater than 35%[a]	Retention Tree Requirements Within SMZ
Class 1 Stream	50	100[b,c]	Retain at least 50% of trees≥ 8-in. on each side of stream or 10 trees per 100 ft segment, whichever is greater
Class 2 Stream	50	100[b,c]	Retain at least 50% of trees≥ 8-in. on each side of stream or 5 trees per 100 ft segment, whichever is greater
Class 3 Stream	50	50	Retain shrubs and submerchantable trees
Lakes	50	100[b,c]	Retain at least 50% of trees≥ 8-in. dbh on each side of stream or 10 trees per 100 ft segment, whichever is greater

[a] Where the normal SMZ boundary intercepts a wetland, the SMZ boundary is extended to include the wetland.

[b] When an established road exists between 50 and 100 ft from the ordinary high water mark (OHWM), the SMZ shifts inward to follow the toe of the road fill.

[c] If the ground slope within the 100-foot SMZ decreases to 15% or less for a width of 30 ft or more to form a bench, the SMZ boundary is the edge of the bench nearest the stream when the edge of the bench is between 50 and 100 ft. If the bench begins within 50 ft of the OHWM and 30 ft or more of the bench extends beyond the 50 ft, then the SMZ boundary is 50 ft.

In addition, DNRC has developed specific rules governing forest practices within the SMZ. Selected rules are cited in following paragraphs.

Rule 3: (36.11.303) - Broadcast Burning

(1) Broadcast burning in the SMZ is prohibited unless approved by the department under a site-specific alternative practice.

Rule 4: (36.11.304) - Equipment Operation in the SMZ

(1) Operation of wheeled or tracked equipment in the SMZ except on established roads is prohibited except as provided in this rule.

(2) In order to permit timber harvest on wetlands under conditions that protect the integrity of the SMZ, an operator may, as an alternative practice without site-specific approval, operate wheeled or tracked equipment from the outside edge of an SMZ to within 50 feet of the ordinary high water mark wherever:

(a) The SMZ extends beyond 50 feet from the ordinary high water mark to include adjacent wetlands;

(b) There exist winter conditions with adequate snow or frozen ground; and

(c) Operation of the wheeled or tracked equipment:

(i) Does not cause rutting or displacement of the soil;

(ii) Protects and retains shrubs and submerchantable trees to the fullest extent possible;

(iii) Does not remove stumps; and

(iv) Otherwise conserves the integrity of the SMZ.

(3) In order to minimize road construction and skid trails necessary for timber harvest on lands adjacent to the SMZ, an operator may, as an alternative practice without site-specific approval, cross the SMZ and the stream or other body of water with wheeled or tracked equipment on a

class 3 stream segment or other body of water at locations spaced approximately 200 feet apart or more provided that:

(a) Crossings are located in areas where the stream or other body of water is dry and the banks and bottoms are stable;

(b) Excavation is minimized;

(c) The capacity of the stream channel or other body of water is maintained; and

(d) The distance traveled through the SMZ is minimized.

(4) In order to minimize road construction necessary for timber harvest on lands adjacent to the SMZ, an operator may, as an alternative practice without site-specific approval, operate wheeled or tracked equipment inside the SMZ off of established roads on the side of the road away from the stream wherever:

(a) An established road exists inside the SMZ or construction of a road inside the SMZ is authorized under ARM 26.6.606;

(b) The toe of the road fill nearest the stream is at least 25 feet from the ordinary high water mark; and

(c) Operations are conducted in such a manner that:

(i) Wheeled or tracked equipment stays out of wetlands except under winter conditions as provided in (2) above;

(ii) All skidding of logs takes place on designated skid trails located approximately 200 feet apart or more;

(iii) all skid trails in such areas are reclaimed by installing erosion control measures and reestablishing vegetative cover;

(iv) drainage features are established or reestablished on all roads used under this section;

(v) logs are not decked on the side of the road toward the stream; and

(vi) no landings are constructed in the SMZ

(5) When logs are being winched or cable yarded across a class 1 or 2 stream segment by equipment located outside the SMZ, logs must be fully suspended unless otherwise authorized pursuant to the Natural Streambed and Land Preservation Act of 1975, 75-7-101.

(6) The department may also approve operation of wheeled or tracked equipment in the SMZ as a site-specific alternative practice only under conditions that:

(a) Conserve the integrity of the SMZ;

(b) Do not cause rutting of the soil; and

(c) Protect the residual stand of shrubs and trees.

Rule 6: (36.11.306) - Road Construction in the SMZ

(1) The construction of roads in the SMZ is prohibited except when necessary to cross a stream or wetland unless approved by the department under a site-specific alternative practice or as provided in this rule. The construction of roads across streams, wetlands or other bodies of water is not regulated by these rules but may be subject to other state and federal laws and regulations.

(2) Road fill material must not be deposited into the SMZ except as needed to construct crossings.

(3) In order to minimize excavation for road construction on erosive soils characteristic of Eastern Montana, an operator may, as an alternative practice without site-specific approval, construct or locate a road inside the SMZ on class 3 stream segments in the eastern zone only wherever:

(a) The slope of the SMZ immediately adjacent to the stream is 10% or less for a distance of at least 25 feet from the ordinary high water mark;

(b) There exists in the outer portion of the SMZ a hillside with slopes in excess of 35%; and

(c) The road is constructed or located on the gentler slopes in such a manner that:

(i) Cutting and filling of earthen material is minimized;

(ii) The toe of the road fill is located at least 15 feet from the ordinary high water mark;

(iii) The road is located as far away from the ordinary high water mark as is practical; and

(iv) Road drainage features are installed as needed to minimize sediment delivery to streams.

Rule 8: (36.11.308) - Side-casting of Road Material

(1) The side-casting of road material into a stream, lake, wetland, or other body of water during road maintenance operations is prohibited in the SMZ.

Rule 9: (36.11.309) - Depositing Slash

(1) Depositing slash in streams, lakes, or other bodies of water is prohibited unless approved by the department under a site-specific alternative practice subject to other state and federal law and regulations.

6.3 BEST MANAGEMENT PRACTICES (BMPS)

Montana DNRC has defined BMPs for forestry in Montana (DNRC 2002b). BMPs are referred to in ARM 36.11.422 (see Section 6.1 for text of rules). Many of the BMPs apply directly to the protection of water quality and aquatic habitat. Although the specific BMPs are not regulatory in and of themselves, adherence to BMPs is presumed to be a primary mechanism for achieving water quality standards for nonpoint source activities in Montana. Therefore, because the implementation of BMPs by DNRC is required under ARM 36.11.422, this effectively makes the application of DNRC BMPs regulatory. A partial list of the BMPs most pertinent to bull trout and their habitat, is excerpted below (in italics) from DNRC (2002b). The BMPs marked with an asterisk are those that are not monitored during routine field audits. For a complete list of BMPs see DNRC (2002b).

III. ROADS

A. Planning and Location

4. Locate roads on stable geology, including well-drained soils and rock formations that tend to dip into the slope. Avoid slumps and slide-prone areas characterized by steep slopes, highly weathered bedrock, clay beds, concave slopes, hummocky topography, and rock layers that dip parallel to the slope. Avoid wet areas, including moisture-laden or unstable toe slopes, seeps, wetlands, wet meadows, and natural drainage channels.

5. *Minimize the number of stream crossings and choose stable stream crossing sites.*

B. *Design*

3. *Design roads to balance cuts and fills or use full bench construction (no fill slope) where stable fill construction is not possible.**

4. *Design roads to minimize disruption of natural drainage patterns. Vary road grades to reduce concentrated flow in road drainage ditches, culverts, and on fill slopes and road surfaces.*

C. *Road Drainage*

1 *Provide adequate drainage from the surface of all permanent and temporary roads. Use outsloped, insloped, or crowned roads, and install proper drainage features. Space road drainage features so peak flow on road surfaces or in ditches will not exceed capacity.*

5. *Provide energy dissipaters (rock piles, slash, log chunks, etc.) where necessary to reduce erosion at outlet of drainage features. Crossdrains, culverts, water bars, dips, and other drainage structures should not discharge onto erodible soils or fill slopes without outfall protection.*

7. *Route road drainage through adequate filtration zones or other sediment-settling structures to ensure sediment doesn't reach surface water. Install road drainage features above stream crossings to route discharge into filtration zones before entering a stream.*

D. *Construction (see also Section V on stream crossings)*

1. *Keep slope stabilization, erosion and sediment control work current with road construction. Install drainage features as part of the construction process, ensuring that drainage structures are fully functional. Complete or stabilize road sections within same operating season.**

2. *Stabilize erodible, exposed soils by seeding, compacting, riprapping, benching, mulching, or other suitable means.*

3. *At the toe of potentially erodible fill slopes, particularly near stream channels, pile slash in a row parallel to the road to trap sediment (example, slash filter windrow). When done concurrently with road construction, this is one method that can effectively control sediment movement, and it can also provide an economical way of disposing of roadway slash. Limit the height, width and length of "slash filter windrows" so wildlife movement is not impeded. Sediment fabric fences or other methods may be used if effective.*

4. *Minimize earthmoving activities when soils appear excessively wet. Do not disturb roadside vegetation more than necessary to maintain slope stability and to serve traffic needs.**

5. *Construct cut and fill slopes at stable angles to prevent sloughing and other subsequent erosion.*

6. *Avoid incorporating potentially unstable woody debris in the fill portion of the road prism. Where possible, leave existing rooted trees or shrubs at the toe of the fill slope to stabilize the fill.*

7. *Consider road surfacing to minimize erosion.**

8. *Place debris, overburden, and other waste materials associated with construction and maintenance activities in a location to avoid entry into streams. Include these waste areas in soil stabilization planning for the road.*

9. *Minimize sediment production from borrow pits and gravel sources through proper location, development and reclamation.*

10. *When using existing roads, reconstruct only to the extent necessary to provide adequate drainage and safety; avoid disturbing stable road surfaces. Prior to reconstruction of existing roads within the SMZ, refer to the SMZ law. Consider abandoning existing roads when their use would aggravate erosion.*

E. *Maintenance*

2. *Maintain erosion control features through periodic inspection and maintenance, including cleaning dips and crossdrains, repairing ditches, marking culvert inlets to aid in location, and clearing debris from culverts.*

5. *Haul all excess materials removed by maintenance operations to safe disposal sites and stabilize these sites to prevent erosion. Avoid sidecasting in locations where erosion will carry material into a stream.**

8. *Leave abandoned roads in a condition that provides adequate drainage without further maintenance. Close these roads to traffic; reseed and/or scarify; and, if necessary, recontour and provide water bars or drain dips.*

IV. TIMBER HARVESTING, AND SITE PREPARATION

A. *Harvest Design*

4. *Design and locate skid trails and skidding operations to minimize soil disturbance. Using designated skid trails is one means of limiting site disturbance and soil compaction. Consider the potential for erosion and possible alternative yarding systems prior to planning tractor skidding on steep or unstable slopes.**

5. *Locate skid trails to avoid concentrating runoff and provide breaks in grade. Locate skid trails and landings away from natural drainage systems and divert runoff to stable areas. Limit the grade of constructed skid trails on geologically unstable, saturate, highly erosive, or easily compacted soils to a minimum of 30%. Use mitigating measures, such as water bars and grass seeding, to reduce erosion on skid trails.*

6. *Minimize the size and number of landings to accommodate safe, economical operation. Avoid locating landings that require skidding across drainage bottoms.*

B. *Other Harvesting Activities*

1. *Tractor skid where compaction, displacement, and erosion will be minimized. Avoid tractor or wheeled skidding on unstable, wet, or easily compacted soils and on slopes that exceed 40 percent unless operation can be conducted without causing excessive erosion. Avoid skidding with the blade lowered. Suspend leading ends of logs during skidding whenever possible.*

2 *Avoid operation of wheeled or tracked equipment within isolated wetlands, except when the ground is frozen (see Section VI on winter logging).*

3. *Use directional felling or alternative skidding systems for harvest operations in isolated wetlands.**

4. *For each landing, provide and maintain a drainage system to control the dispersal of water and to prevent sediment from entering streams.*

C. Slash Treatment and Site Preparation

1. Rapid reforestation of harvested areas is encouraged to reestablish protective vegetation.

8. Limit water quality impacts of prescribed fire by constructing water bars in firelines; not placing slash in drainage features and avoiding intense fires unless needed to meet silvicultural goals. Avoid slash piles in the SMZ when using existing roads for landings.

V. STREAM CROSSINGS

A. Legal Requirements

1. Under the Natural Streambed and Land Preservation Act of 1975 (the "310 law"), any activity that would result in physical alteration or modification of a perennial stream, its bed or immediate banks must be approved in advance by the supervisors of the local conservation district. Permanent or temporary stream crossing structures, fords, riprapping or other bank stabilization measures, and culvert installations on perennial streams are some of the forestry-related projects subject to 310 permits.

Before beginning such a project, the operator must submit a permit application to the conservation district indicating the location, description, and project plans. The evaluation generally includes on- site review, and the permitting process may take up to 60 days.

2. Stream-crossing projects initiated by federal, state or local agencies are subject to approval under the "124 permit" process (administered by the Department of Fish, Wildlife and Parks), rather than the 310 permit.

3. A short-term exemption (3a authorization) from water quality standards is necessary unless waived by the Department of Fish, Wildlife and Parks as a condition of a 310 or 124 permit. Contact the Department of Environmental Quality in Helena at 444-2406 for additional information.

B. Design Considerations (Note: 310 permit required for perennial streams)

1. Cross streams at right angles to the main channel if practical. Adjust the road grade to avoid the concentration of road drainage to stream crossings. Direct drainage flows away from the stream crossing site or into an adequate filter.

2. Avoid unimproved stream crossings. When a culvert or bridge is not feasible, locate drive-throughs on a stable, rocky portion of the stream channel.

C. Installation of Stream Crossings (Note; 310 permit required for perennial streams)

1. Minimize stream channel disturbances and related sediment problems during construction of road and installation of stream crossing structures. Do not place erodible material into stream channels. Remove stockpiled material from high water zones. Locate temporary construction bypass roads in locations where the stream course will have minimal disturbance. Time construction activities to protect fisheries and water quality.

2. When using culverts to cross small streams, install those culverts to conform to the natural stream bed and slope on all perennial streams and on intermittent streams that support fish or that provides seasonal fish passage. Ensure fish movement is not impeded. Place culverts slightly below normal stream grade to avoid culvert outfall *barriers. Do not alter stream channels upstream from culverts, unless necessary to protect fill or to prevent culvert blockage.*

3. *Design stream-crossings for adequate passage of fish (if present), minimum impact on water quality, and at a minimum, the 25-year frequency runoff. Consider oversized pipe when debris loading may pose problems. Ensure sizing provides adequate length to allow for depth of road fill.*
4. *Install stream-crossing culverts to prevent erosion of fill. Compact the fill material to prevent seepage and failure. Armor the inlet and/or outlet with rock or other suitable material where feasible.*
5. *Consider dewatering stream crossing sites during culvert installation.**
6. *Maintain a 1-foot minimum cover for stream-crossing culverts 15 to 36 inches in diameter, and a cover of one-third diameter for larger culverts, to prevent crushing by traffic.*
7. *Use culverts with a minimum diameter of 15 inches for permanent stream crossings.**

It should be noted that work is currently underway to modify BMPs for fish passage (G. Frank, 2003b, personal communication).

D. *Existing Stream Crossing*

1. *Existing stream crossing culverts shall have adequate length to allow for road fill width and have adequate capacity to allow for the passage of the 25-year frequency runoff. To prevent erosion of fill, provide or maintain armoring at inlet and/or outlet with rock or other suitable material where feasible. Maintain fill over culvert as described in V.C. 6.*

7. ADDITIONAL PROTECTIVE MEASURES DEVELOPED BY OTHER AGENCIES/HCPS

In addition to the protective measures that are directly applicable to DNRC (including those measures regulatory in nature or those developed by or for DNRC), other agencies/entities have also developed protective measures for bull trout and their habitat. These measures, which are summarized below, include INFISH guidelines developed by the USFS and those measures covered under the Plum Creek HCP for forest activities in Montana. These measures are not required to be enforced by DNRC.

7.1 INLAND NATIVE FISH STRATEGY (INFISH)

The USFS has adopted the *Inland Native Fish Strategy* (INFISH) *Selected Interim Direction* (USFS 1995). INFISH is a strategy to apply federal management guidelines for protection of inland native fish to reduce the risk of population loss and negative impacts to aquatic habitat. This amendment included the establishment of Riparian Management Objectives (RMOs) and Riparian Habitat Conservation Areas (RHCAs). The INFISH strategy consists of several components, including:

- Interim RMOs to achieve riparian goals,
- delineation of RHCAs,
- development of standards and guidelines, and
- monitoring requirements.

Specific standards and guidelines were developed in INFISH management strategies associated with road management, grazing, recreation, minerals, fire/fuels, lands, general riparian management, watershed and habitat restoration, and fisheries and wildlife restoration.

The INFISH component that specifically relates to fish and in-stream habitat quality is referred to as RMO. The RMO objectives identify habitat criteria regarding water temperature, LWD, pool frequency, width/depth ratio, and bank stability (USFS 1995). The six individual RMOs (Table 3) are discussed below.

Table 3. Interim Riparian Management Objectives Under INFISH

Parameter	INFISH Riparian Management Objective Guideline
Water Temperature	No measurable increase in maximum water temperature (7-day moving average of daily maximum temperature measured as the average of the daily maximum temperature warmest 7-day period). Maximum water temperature below 15°C within adult fish holding habitat and below 9°C within spawning and rearing habitat.
Large Woody Debris	> 20 pieces per mile; > 12 inch diameter; > 35 ft. length
Pool Frequency	Wetted width of 10 ft = 96 pools per mile; wetted width of 20 ft = 56 pools per mile
Width/Depth Ratio	< 10, mean wetted width divided by mean depth
Streambank Stability	> 80 percent stable
Lower Bank Angle	> 75% of banks with < 90° angle

Source: USFS (1995).

RHCAs are *areas within a watershed where riparian-dependent resources receive primary emphasis, and management activities are subject to specific watershed standards* (USFS 1995). Interim RHCA widths would apply where watershed analysis has not been completed. Site-specific widths may be increased where necessary to achieve riparian management goals and objectives, or decreased where interim widths are not needed to attain RMOs or avoid adverse effects. Establishment of RHCA's would require completion of watershed analysis to provide the ecological basis for the change. However, interim RHCAs may be modified by amendment in the absence of watershed analysis where stream reach or site-specific data support the change.

The USFS has developed project and site-specific standards and guidelines that apply to all RHCAs and to projects and activities in areas outside RHCAs that are identified through National Environmental Policy Act (NEPA) analysis as potentially degrading RHCAs. Under the strategy, the standards and guidelines would be applied to the entire geographic area for the project. Specific standards and guidelines were developed and identified for activities such as timber management, road management, and grazing management, as well as for watershed and fisheries habitat restoration. A complete list of all standards and guidelines is contained in USFS (1995).

7.2 PLUM CREEK NATIVE FISH HCP

The *Plum Creek Native Fish HCP* covers 1.6 million acres of Plum Creek Timber Company lands in Montana, Idaho, and Washington as well as access roads leading to those lands on which Plum Creek has some management responsibility (Plum Creek Timber Company 2000). The HCP was developed as part of issuing an incidental take permit for certain listed species. Bull trout is a species covered by the plan. Covered activities include:

- commercial forestry and associated activities,
- forest fire suppression,
- open range and leased cattle grazing,
- miscellaneous forest product sales,
- conservation activities,
- special forest use permits, and
- forest products manufacturing.

Habitat goals and objectives are based on the general principle that native salmonids generally prefer habitat that consists of cold, clean, complex, and connected waters. Biological goals of the Plum Creek HCP include these four habitat parameters; cold, clean, complex, and connected. Further description of the four goals and the objectives listed within the Plum Creek HCP to achieve the goals, is provided below.

Cold

Goal: Protect stream temperatures where they are suitable for fish and contribute to restoration of temperatures where past project area management has rendered them unsuitable.

<u>*Objectives:*</u>

1. *Minimize impacts to canopy closure and changes in channel morphology resulting from riparian timber harvest and grazing.*

2. *Improve the ability of riparian vegetative communities to provide canopy closure over streams through passive and active restoration.*
3. *Create a net increase in canopy closure over streams.*

Clean

Goal: Protect instream sediment levels where they are suitable for fish and contribute to restoration of instream sediment levels where they have been impacted by past project area management.

Objectives:

1. *Minimize sediment delivery to streams resulting from the construction of new roads and timber harvesting.*
2. *Reduce sediment delivery to streams from existing roads.*
3. *Create a net reduction in sediment delivery to streams.*
4. *Contribute to restoration of the function of riparian vegetative communities for sediment filtration and stream bank stability.*

Complex

Goal: Protect instream habitat diversity where it is suitable for fish and contribute to restoration instream habitat diversity where it has been impacted by past project area management.

Objectives:

1. *Minimize impacts to large woody debris recruitment and bank stability in harvested streamside stands.*
2. *Minimize impacts to overhanging stream banks because of grazing or riparian harvest.*
3. *Improve the ability of riparian forests to provide a broad range of riparian functions to streams.*
4. *Improve the ability of riparian vegetative communities to develop overhanging banks and other habitat diversity through passive or active restoration.*
5. *Create a net increase in large woody debris recruitment potential and other riparian functions in the project area.*

Connected

Goal: Protect and contribute to restoration of connectivity among subpopulations of native fish in the project area.

Objectives:

1. *Avoid creating fish passage barriers when constructing stream crossings.*
2. *Restore fish passage where existing road stream crossings restrict passage.*
3. *Cooperate to restore fish migration where restricted by other factors such as irrigation diversions or thermal barriers.*

To achieve these habitat goals and objectives, specific BMPs were developed to address commitments for road and upland, riparian, and range management. Road and upland management BMPs address sediment delivery reduction and slope stability associated with planning, design, construction, and maintenance of roads and skid trails. Riparian management BMPs use state riparian regulations as a minimum requirement and incorporate protective measures specific to streams having channel migrations zones (CMZ), high sensitivity streams without CMZs, other perennial fish-bearing streams, headwater streams, and areas of riparian-upland interface. Commitments for grazing management primarily include grazing exclosures, effectiveness monitoring, and rancher training. In addition, the Plum Creek HCP also specifies strategies and regulations for land use planning, monitoring, and adaptive management.

8. EXISTING DNRC MONITORING AND RESEARCH PROGRAMS

According to ARM 36.11.424, the DNRC is required to develop and maintain a monitoring strategy to assess watershed impacts of land use activities and the effectiveness of mitigation measures. In general, such a strategy is to include qualitative assessments (such as BMP audits), site-specific quantitative assessments on selected sites, habitat assessments of streams that support listed or sensitive species, and an inventory of watershed impacts, as funding allows to determine BMP effectiveness. Such assessments are also intended to identify causes of watershed degradations and set priorities for restoration while maintaining beneficial uses. The DNRC intends to use monitoring information in an adaptive management approach to correct identified impacts resulting from forest management practices and modify applied mitigations or future activities to avoid observed impacts. In addition, DNRC is required to participate in cooperative watershed monitoring efforts with other agencies, and public and private parties.

Most watershed and fisheries monitoring efforts occurring on state forest lands are either strictly qualitative assessments, such as BMP audits, or site specific assessments associated with specific management activities or mitigation measures that have the potential for environmental impacts (G. Frank, 2003b, personal communication). Most assessments are done on an as needed basis.

8.1 WATERSHED MONITORING

A Water Quality Monitoring Program adopted in 1999 by DNRC is a plan for the implementation of all watershed related monitoring commitments made in the State Forest Land Management Plan (SFLMP). The three goals of this program are to:

1. determine sources of watershed impairment on school trust land and develop strategies for remedial actions,
2. monitor the implementation of BMPs and other mitigation measures, and
3. investigate relationships between land-use activities and watershed integrity of aquatic systems on state land.

To accomplish Goal 1, DNRC is systematically completing watershed inventories throughout the state in priority drainage basins. Goal 2 is to be accomplished through timber sale contract inspections and BMP audits. Goal 3 is to be accomplished by implementing project level monitoring at specific sites.

Specific detail on watershed monitoring, as listed in the SFLMP, include the following:

- Contract administration would be the primary form of monitoring. The stipulations and requirements contained in Environmental Assessments (EAs) and project contracts would be periodically evaluated by contract administrators. Deficiencies would be corrected as they were observed by the contractor, under supervision of DNRC.
- Qualitative assessments, such as BMP audits, would be conducted as time allowed and appropriate sites were available. Problems noted would be remedied by DNRC. BMPs that fail to provide adequate protection would be revised for future application.
- Water quality monitoring would be conducted on a representative sample of streams in areas of contiguous ownership to track trends in water quality. The data collected is generally not of adequate resolution to be used for cause and effect relationships of specific land management activities. As suitable projects became available, monitoring of individual projects would be

considered. If monitoring indicated watershed impacts from management activities, problems would be corrected.

- The impacts of timber management on the physical soil properties would be evaluated using quantitative methods on a limited number of sites as time allowed. The information collected would be used to identify the need for mitigation measures and the need to modify future activities to avoid similar impacts.

8.1.1 Watershed Inventories

During watershed inventories, all roads, stream crossings, stream channels, and stream reach riparian areas are surveyed to identify existing or potential sources of erosion and sediment delivery to streams. As of fiscal year 2000, approximately 51,979 acres of school trust lands were inventoried. Inventories were conducted in the Alaska, Beaver/Bear Creek, West Clearwater, W. Fork Swift Creek, Elk Creek, Lyman Creek, Lyons Creek, Praine/Andrew Creek, W. Fork Swift Creek, Whitetail Creek, Wolf Creek, and Woodward Creek drainages. During inventories, all roads, stream crossings, and stream reaches were surveyed to identify existing or potential sources of erosion and sediment delivery potential.

8.1.2 Timber Sale Contract Inspections

Timber sale contract inspections are periodically conducted while timber sales are active. Visual, qualitative evaluations are conducted to determine whether practices are being correctly applied during harvest and road construction activities. There are 23 standard items evaluated. Reporting categories are satisfactory, needs improvement, or violation.

8.1.3 BMP Audits

BMP audits are conducted during or shortly after completion of DNRC timber sales. During BMP audits, practices implemented during harvest activities are rated for proper application and effectiveness in preventing impacts to soil and water resources. Audits are conducted during or shortly after harvest operations. This monitoring effort is qualitative and requires only visual estimations of BMP applications and effectiveness, rather than measurement of habitat attributes or impacts. Therefore, evaluation of impacts is subjective. A standard BMP audit worksheet is used to aid in obtaining the following types of information:

- site information: drainage, unit size, road construction lengths, logging methods, site slope, soil erodibility;
- assessment of roads (aspects of planning, location, design, drainage, construction, and maintenance);
- timber harvest activities (harvest design, skidding operations, slash treatments);
- stream crossings (proper permitting, design considerations, installation impacts);
- handling of hazardous substances; and
- SMZ information (adequate SMZ maintained according to regulations, properly marked, tree retention requirements met, and the exclusion of equipment operations, road construction, deposition of road fill, sidecasting of road fill, slash, and hazardous materials).

8.1.4 Project Level Monitoring

Several site-specific monitoring projects are designed by DNRC to quantitatively determine BMP effectiveness and mitigation measures at reducing non-point source pollution. An example of project level monitoring was conducted for the Sula State Forest Fire Mitigation Salvage Recovery Project (DNRC 2002a). Monitoring efforts included the following assessments:

- BMP audits;
- effectiveness of SMZ buffers (LWD recruitment and retention, stream shade retention);
- soil disturbance and erosion;
- water quality monitoring (pH, total suspended solids, soluble phosphates, total phosphates, and nitrates;
- stream temperature (continuous recording on study and reference reaches);
- stream channel geomorphology (cross-section and longitudinal);
- riparian conditions (plant species composition, abundance, and browse utilization along defined transects); and
- visual assessment of streambank erosion.

Another example of project level monitoring was conducted for the Moose Fire Salvage and Restoration Project (DNRC 2003b). In August and September of 2001, the Coal Creek State Forest was extensively burned by the Moose Wildfire. Following this fire, DNRC assessed the fire area for rehabilitation and reforestation needs, and a salvage plan was completed that incorporated such measures. A monitoring plan was designed to:

- compare soil conditions and erosion on harvested and non-harvested sites,
- assess the effectiveness of salvage harvest mitigation,
- evaluate the levels of post-fire ground vegetation canopy cover, and
- recommend future management strategies.

The fire area was assessed for burn severity, soil conditions, coarse woody debris, fine woody debris, vegetative cover, erosion (using sediment fencing and erosion traps), and soil density.

Similar project-level monitoring efforts were conducted for the following sites and activities (DNRC 2000):

- Quiet Stems Timber Sale,
- Blanchard Creek Stream/Riparian Restoration,
- Little Thompson River Grazing Management,
- Praine Creek/Andrews Creek Riparian Restoration,
- Swan State Forest Water Quality Monitoring,
- Stillwater State Forest Water Quality Monitoring, and
- reference reach monitoring (control sites established on certain streams for the collection of channel morphology, LWD, riparian conditions, macroinvertebrate assessments, and water temperatures).

8.2 FISHERIES MONITORING

Most fisheries habitat monitoring is conducted in the form of the watershed monitoring efforts described above. The DNRC also participates in the Flathead Basin Monitoring Committee, the Westslope Cutthroat Trout Steering Committee, and the Bull Trout Restoration Team as part of the Flathead Basin monitoring program, which was established in 1992. On the Swan, Stillwater, and Coal Creek State Forests within the Flathead River basin, watershed conditions (according to watershed monitoring methods as described above) and fisheries habitat were evaluated over several years with emphasis on westslope cutthroat trout and bull trout habitat. Similar monitoring efforts were expanded to the Southwestern and Central Land Offices.

8.2.1 Fisheries Monitoring Requirements, as Listed in the SFLMP

In conjunction with land management activities, DNRC also monitors fisheries habitat conditions in areas identified as critical bull trout and westslope cutthroat trout habitat in the Flathead Basin as prescribed in the *Flathead Basin Forest Practices and Fisheries Cooperative Program Final Report*, Recommendation #17.

Timber sale contract administration is the primary form of project monitoring. The stipulations and requirements contained in EAs and project contracts are periodically evaluated by contract administrators. Deficiencies are corrected by the contractor, as observed, under supervision of DNRC.

8.2.2 Swan River, Stillwater, and Coal Creek State Forests

The following habitat attributes are monitored by MFWP under contract with DNRC:

- substrate scores (particle size and percent embeddedness),
- streambed core samples (actual measurement of substrate particle sizes),
- westslope cutthroat trout and bull trout redd counts, and
- fish species composition.

8.2.3 Southwestern and Central Land Offices

The following habitat attributes are monitored:

- fish species presence/absence,
- fish population surveys,
- fish species distribution,
- bull trout genetic sampling,
- westslope cutthroat trout genetic sampling,
- fish habitat surveys according to Level II protocols of the *R1/R4 (Northern/Intermountain Regions) Fish and Fish Habitat Standard Inventory Procedures Handbook* (Overton et al. 1997), and
- macroinvertebrate sampling according to *Rapid Bioassessment Protocols* (Bukantis 1998).

Data collected specifically on forested state trust lands is associated with project level monitoring and fisheries monitoring efforts as described above. Other fisheries research and monitoring efforts are currently being developed as part of a long-term fisheries program (Bower 2003 personal communication).

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